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ABSTRACT

As a followup to a 1969 study, called Project CASE, a survey was initiated to determine to what extent computers are used in secondary public schools, and to discern to what extent computers affect the quality of education. Some 5,580 randomly selected schools were questioned about their use of computers; commercial computer manufacturers were queried about the availability of computer technology suitable for use in the secondary schools; the specific exemplary programs using computers were identified. For the period 1970-75, some major findings were: (1) the use of computers is expanding; (2) schools tend to use computers for both instruction and administration; (3) computer-assisted instruction is being used more but it continues to be employed predominantly in the instruction of computer science and mathematics; (4) with regard to administration, the computer is most frequently used for student accounting and resource management; and (5) BASIC has become the predominant language. The characteristics of schools using computers, the levels of their spending, and the sources of their funding are discussed. (EMH)

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COMPUTING ACTIVITIES IN SECONDARY EDUCATION

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September 1975

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COMPUTING ACTIVITIES IN SECONDARY EDUCATION

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FINAL REPORT

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EXECUTIVE SUMMARY

In the fall of 1969 the American Institutes for Research (AIR) undertook a study for the National Science Foundation (NSF) to determine the extent and type of computer use in U.S. public secondary schools. The study was commissioned by NSF because there were no comprehensive and current data available upon which to base sound planning, policy, and funding decisions. The resulting report--"Survey of Computing Activities in Secondary Schools" was published in October 1970 and represented a significant contribution to the knowledge of the state-of-the-art in educational computer applications. It represented the first serious attempt at assembling a comprehensive overview of computer use in this significant educational sector.

In early 1974 AIR proposed that the original study of computers in secondary schools be repeated since there was once again a lack of current information. In addition to updating the original data, a second and comparable study would allow for the analysis of trends and estimates of future growth and directions. The second study was funded and started in June 1974.

Research Design

A national survey of secondary schools was initiated which included the administration of the Project CASE school questionnaire to a stratified random sample of public secondary schools in the country, and the amplification of the statistical survey results by (1) a longitudinal study of a sample of schools participating in the 1970 study; (2) a survey of computer manufacturers to determine the types of computer systems used by secondary schools, and (3) the identification of exemplary programs in schools that are using the computer in their instructional program in an innovative fashion.

The questionnaire consisted of five sections and required a respondent to answer 44 individual questions about their school's computing activities. The major sections of the questionnaire were:

1. General information about the school;
2. A listing in checklist format of a school's specific Instructional and Administrative Applications;

3. General school budget and a specific budget for Administrative and/or Instructional Computing;

4. The type of computer hardware employed by the school;

5. A detailed description of a school's Instructional Application(s).

Project CASE questionnaires were mailed to 25 percent of the public secondary schools selected from the Public School Universe file developed and maintained by the National Center for Educational Statistics. From the more than 22,000 public secondary schools listed on the file, 5,580 were randomly selected by a specially developed computer program.

Results

In general, the study provides both a quantitative and qualitative review of the extent and nature of computer use in secondary schools. With a primary focus on instructional computing, the study shows the growth of secondary school computer applications since 1970 and explores the current state and future of instructional computing at the secondary school level.

Some of the major findings were:

- Since 1970 computing in secondary education has steadily increased with 58.2 percent of the schools responding to Project CASE survey indicating they are currently using a computer for administrative and/or instructional purposes (versus 34.4 percent in 1970).

- The trend is toward more fully using the computer. Of schools using computers, only those using them for both administrative and instructional uses increased from 1970 to 1975 (26.2 percent versus 37.5 percent). The percentage of schools using computers for only administrative or instructional purposes dropped from 1970 to 1975 (62.5 percent) versus 54.1 percent administration; 11.3 percent versus 8.4 percent instructional).

- Given the findings concerning the growth of secondary school computing for the last five years (1970-1975), and with the assumption that the current rate of adoption of computer technology in the schools (4.8 percent/year) will continue, it can be projected that within the next decade every secondary school in the country will have access to a computer system for some type of administrative and/or instructional application.

- Respondents indicated that using the computer as a "Problem Solving Tool" and as a subject for "Computer Science" courses were the most frequently utilized instructional applications in secondary education.

- In schools using computers CAI has increased from 8.4 percent in 1970 to 13.8 percent in 1975.

- The predominant instructional use of computers in 1975 is still for Mathematics instruction.

- With regard to administration the most frequent uses of the computer are for Student Accounting and Resource Management.

- The BASIC language has become the predominant computer language for instructional computing.

Summary and Conclusions

Though the use of computers has not as yet been universally introduced in every school, the adoption of computer technology in secondary education has been both steady and stable with more and more schools accessing computers each year while fewer schools are terminating a previously established computer application. Thus, despite generally rising costs for school operation and tight budgets, individual schools and school systems are committing locally generated educational dollars to computerize their information management systems and to enhance the quality of their instructional programs.

Drawing upon the information storage and retrieval capacity of computers, secondary schools, frequently in conjunction with their school system, have attempted to streamline the administrative functions of school operation by effective use of the computer for such tasks as payroll, cost accounting, personnel records, resource management of inventories and supply requisitions, student scheduling, report cards, and pupil attendance. With the aid of the computer, these administrators now have rapid access to the school's records systems so that they may continually monitor, evaluate, and efficiently administer the operation of their school. In addition, an increasing number of schools have turned to the use of the computer for instructional purposes. Most frequently an instructional application takes the form of computer science or data processing course offerings that include operation of unit record equipment, computer programming, and computer system operation. Another

prominent application is the use of the computer as a tool for problem solving primarily in mathematics and in the physical and social sciences. Other important instructional applications include using the computer:

- to teach specific subjects in a computer-assisted instruction format;
- to guide a student's progress through an individualized course of instruction in a computer-managed instruction format;
- for disseminating guidance information concerning vocations, college entrance requirements and course offerings, or employment opportunities; and
- for gaming and simulation of scientific and social science problems to test the skill and ingenuity of students attempting to apply their knowledge to real life situations.

Of significance is the fact that computer technology has found its place in American secondary education. Despite earlier difficulties with the applications of computers, secondary education has increasingly looked to the computer as a means to better administer the school's operation and as a tool to enhance the learning process. As reflected by the results of the Project CASE survey, American secondary education is slowly and steadily catching up with business and industry in applying the many benefits of the computer to meet the needs of education. Since the experimental or trial phase of computer applications in secondary education seems to be completed, the question confronting secondary education today is not whether the computer belongs in secondary schools, but rather how can computer technology best be used by administrators and teachers to provide all students a more rewarding and challenging learning experience. The resolution of this question will ultimately determine the total impact of the computer on improving the quality of American secondary education.

INTRODUCTION

In the fall of 1969 the American Institutes for Research undertook a study for the National Science Foundation (NSF) to determine the extent and type of computer use in U.S. public secondary schools. The study was commissioned by NSF because there were no comprehensive and current data available upon which to base sound planning, policy, and funding decisions. The resulting report--"Survey of Computing Activities in Secondary Schools" was published in October 1970 and represented a significant contribution to the knowledge of the state-of-the-art in educational computer applications. It represented the first serious attempt at assembling a comprehensive overview of computer use in this significant educational sector.

In early 1974 AIR proposed that the original study of computers in secondary schools be repeated since there was once again a void of current information. In addition to updating the original data, a second and comparable study would allow for the analysis of trends and estimates of future growth and directions. The second study was funded and started in June 1974.

The data from this recently completed study has shown that during the last five years secondary education has experienced a quiet revolution that has seen the modernization of school administration and the enrichment of the learning process. Sparked by the potential benefits of computer technology, thousands of secondary schools have since 1970 integrated the information and instructional services that computers provide into their school's program. As shown by the Project CASE (Computing Activities in Secondary Education) survey, over 58 percent of the nation's secondary schools today use a computer to aid their administrative or instructional programs. Compared to AIR's previous survey of public secondary schools conducted in 1970, the level of secondary school computing has increased by 24 percent (from 34 to 58 percent). Though the use of computers has not as yet been universally introduced in every school, the adoption of computer technology in secondary education has been both steady and stable with more and more schools accessing computers each year while fewer schools are terminating a previously established computer application. Thus, despite generally rising costs for school operation and tight budgets,

individual schools and school systems are committing locally generated educational dollars to computerize their information management systems and to enhance the quality of their instructional programs.

Secondary schools have drawn upon the information storage and retrieval capacity of computers and frequently in conjunction with their school system, have attempted to streamline the administrative functions of school operation by effective use of the computer for such tasks as payroll, cost accounting, personnel records, resource management of inventories and supply requisitions, student scheduling, report cards, and pupil attendance. With the aid of the computer, these administrators now have rapid access to the school's records systems so that they may continually monitor, evaluate, and efficiently administer their school. In addition, an increasing number of schools have turned to the use of the computer for instructional purposes. Most frequently an instructional application takes the form of computer science or data processing course offerings that include operation of unit record equipment, computer programming, and computer system operation. Another prominent application is the use of the computer as a tool for problem solving primarily in mathematics and in the physical and social sciences. With the computer, students write their own programs to solve problems encountered in their specific courses. This might take the form of solving a set of simultaneous equations or predicting the outcome of a scientific experiment. Other important instructional applications include using the computer:

1. to teach specific subjects in a computer-assisted instruction format;

2. to guide a student's progress through an individualized course of instruction in a computer-managed instruction format;

3. for disseminating guidance information concerning vocations, college entrance requirements and course offerings, or employment opportunities; and

4. for gaming and simulation of scientific and social science problems to test the skill and ingenuity of students attempting to apply their knowledge to real life situations.

Of significance is the fact that computer technology has found its place in American secondary education. Despite earlier difficulties with

the application of computers in education caused in part by inexperienced personnel, inefficient computer systems, and high costs of implementation, secondary education has increasingly looked to the computer as a means to better administer the school's operation and as a tool to enhance the learning process. As reflected by the results of the Project CASE survey, American secondary education is slowly and steadily catching up with business and industry in applying the many benefits of the computer to meet the needs of education. The experimental or trial phase of computer applications in secondary education seems to be completed. Although the task of "educating the educator" in computer technology is far from over, school administrators, teachers, students, and parents tend to view the advent of computer technology in the educational program as an inevitable part of secondary education. The question confronting secondary education today is not whether the computer belongs in secondary schools, but rather how can computer technology best be used by administrators and teachers to provide all students a more rewarding and challenging learning experience. The resolution of this question will ultimately determine the total impact of the computer on improving the quality of American secondary education.

RESEARCH DESIGN

Overview

A national survey of secondary schools was conducted to determine the extent and type of computer use in public secondary education. The study included the administration of the Project CASE school questionnaire to a 25 percent stratified random sample of public secondary schools in the country, and the amplification of the statistical survey results by (1) a longitudinal study of a sample of schools participating in the 1970 study; (2) a survey of computer manufacturers to determine the types of computer systems used by secondary schools, and (3) the identification of exemplary programs in schools that are using the computer in their instructional program in an innovative fashion.

In general, the study provides both a quantitative and qualitative review of the extent and nature of computer use in secondary schools. With a primary focus on instructional computing, the study shows the growth of secondary school computer applications since 1970 and explores the current state and future of instructional computing at the secondary school level.

Project CASE Questionnaire

The Project CASE questionnaire (Appendix A) was developed by modifying the survey instrument used in AIR's previous study of computing activities in secondary schools (Darby, Korotkin, Romashko, 1970). The original questionnaire was reviewed and revised by Project CASE's Advisory Board and the project's staff. Based on the previous experience with the questionnaire, all unnecessary data elements were removed and ambiguous questions were modified. Upon completion of the revisions the survey instrument was pilot tested with local school administrators from the State of Maryland (Montgomery County). The pilot testing provided the opportunity to assess the clarity and meaningfulness of the questionnaire for school administrators that currently utilize a computer as well as for those who do not currently have a computer application. The draft questionnaire was revised in accordance with the results of the pilot testing and printed in a form suitable for mailing.

The final questionnaire consists of five sections and requires a respondent to answer 44 individual questions about their school's computing activities. The sections of the questionnaire are as follows:

1. General information about the school (type of school, enrollment, current computer use, source of funding, projected computer use, etc.);

2. A listing in checklist format of a school's specific Instructional Applications (i.e., computer-assisted instruction, computer science, etc.) and Administrative Applications (i.e., student accounting, resource management, research, etc.);

3. General school budget and a specific budget for Administrative and/or Instructional Computing;

4. The type of computer hardware employed by the school;

5. A detailed description of a school's Instructional Application(s) (i.e., subject areas, number of students and teachers involved, type of programming language, etc.); agencies providing cooperative support; evaluation findings concerning the effectiveness of their computer application(s); and their assessment of the general impact of the computer on the instructional program.

The reader is referred to the survey instrument (Appendix A) for the definitions of all terminology employed by the study (i.e., computer, computer-assisted instruction, etc.) and for the identification of all information elements encompassed by this study.

School Population and Sample

Project CASE questionnaires were mailed to a 25 percent stratified random sample of public secondary schools selected from the Public School Universe file developed and maintained by the National Center for Educational Statistics. From the more than 22,000 public secondary schools listed on the file, 5,580 were randomly selected by a specially developed computer program. For this study a secondary school was defined as one that had one or more of the following grades: 9, 10, 11, or 12. Thus schools with grade levels such as 1 through 12, 7 through 9, 9 to 10, 12 alone, etc. were eligible for selection.

The sample was stratified in terms of the number of schools within a state, thus insuring a proportionate representation in the sample of schools from all 50 states plus Puerto Rico, Samoa, and Gua[illegible]

Survey Procedure

A Project CASE questionnaire was sent to the principal of each high school selected as part of the study's sample. Accompanying the questionnaire was a letter to the principal indicating the purpose and the importance of the study and requesting his assistance in providing the requested information (see Appendix A). Since the completion of the questionnaire required both general and specific knowledge of a school's computer application(s), e.g., current levels of use, types of instructional applications by subject area, levels of expenditures for computing by the school, etc., it was suggested that each section of the questionnaire be assigned to a staff member most knowledgeable in that aspect of the program (i.e., the hardware configuration section could be completed by the school's data processing specialist) and that one person be assigned to coordinate the completion of the survey and be responsible for its return.

In addition to and concurrent with the direct school mailing a computer-generated letter was developed and mailed to the Superintendent of Schools for each school system in the sample (Appendix A). The letter described the nature of the study and listed within the body of the letter the names of the schools from that school district selected for the study. The letter requested the superintendent's support and cooperation for the research effort. A copy of the questionnaire was also included for his review and retention.

To maximize the response rate a series of follow-up mailings were initiated to nonrespondent schools. Approximately eight weeks after the first school mailing a second questionnaire was sent to each principal requesting his/her participation in the study. Following that mailing, a condensed one-page version of the questionnaire was submitted to schools that had not responded to the previous two mailings (Appendix A). The modified version consisted of three essential questions for the study (i.e., a school's current use of the computer, source of funding, and

intended new applications within the next school year). Like the longer version the condensed questionnaire could be folded and returned postage paid. Finally, to insure that all schools likely to respond would have the opportunity to participate in the study, a follow-up mailing was sent to the system superintendent of nonresponding schools. Enclosed within the mailing was a copy of the condensed version of the questionnaire for each school from his district that had not yet participated in the survey. The superintendent was requested to complete a questionnaire for each school still outstanding from the study and return the completed forms in the self-addressed and posted envelope provided in the mailing.

As a result of the initial and follow-up mailings to school principals and superintendents, 3,643 responses were received for a 65.3 percent rate of response. Despite the fact that school administrators are often inundated by survey requests from the federal government, professional and student researchers, and commercial firms; that many school districts require a researcher to obtain special permission from the school board or a local research board before a school can respond to a survey; and, that several large school districts do not, as a school system policy, respond to questionnaires, the majority of the 5,580 schools surveyed did participate in the study.

Verification Study

To determine if the school response to the survey was biased by some independent variable, i.e., whether a school used a computer or not, whether the school was large or small, the geographic location of the school, etc., a telephone verification study of a random sample of nonrespondent schools was conducted. The principals were asked the same three questions listed on the condensed version of the questionnaire, as well as the size of the school. In addition, the principals were asked what difficulties they encountered in responding to the survey, i.e., did they in fact receive the survey mailed to them; etc. Analysis of the telephone interviews with these school principals indicated that in fact the ratio of user to nonuser schools was roughly comparable to the major survey. That is, 56 percent of the nonrespondent schools did have access to a computer for either administrative or instructional purposes, while

44 percent were nonuser schools. The full survey found a 58 percent to 42 percent user to nonuser school ratio. Also the interviews did not identify any significant factor that might have biased the results of the survey. Rather, the explanations provided by nonresponding principals seemed to indicate that a school's participation in the study tended to reflect the individual idiosyncracies of the principal or secondly, the explicit survey policy of that school's district.

To assess if school response differed between geographic regions of the country (Northeast, South, Northcentral, and West) returns from each region were tabulated. It was found that each region had comparable rates of response with 67.8 percent of the schools in the sample from the Northeast responding to the survey, 60.1 percent of the schools from the South responding, 69.2 percent of the schools from the Northcentral region returning questionnaires, and 70.3 percent of the schools in the sample from the West participating in the study.

In general, the verification study supports the conclusion that the survey returns represent an unbiased and representative picture of the extent and scope of secondary school computing at the national level.

Data Analyses Procedures

Upon receipt of a completed questionnaire, school responses to individual questions were coded and keypunched for computer data processing. Data Analyses procedures included the calculation of frequencies and percentages of response for each data category. User school and nonuser school data files were constructed and analyzed by employing the Marginals and Cross tabulations programs of the Statistical Packages for the Social Sciences (Nie, et al, 1970).

Amplification Study

In support of the statistical survey of computing activities in secondary schools, a series of amplification studies were conducted to elaborate upon the present state of secondary school computing and to make more meaningful the findings of the general survey. The amplification study consisted of three distinct activities. The first substudy explored

the current status of computing within the secondary schools that answered the 1970 survey and that had at the time of the study one or more instructional computer applications. From telephone interviews with these school principals, the study provides some insight into the problems and progress experienced by user schools over the last five years. The results of the interviews with school principals are incorporated into the report and are used to amplify the quantitative comparison of findings from the 1970 and the 1975 surveys.

A second facet of the amplification study involved a survey of computer manufacturers (main frame) to determine the common types of computer systems currently employed in secondary educational settings. The survey lists computer systems commonly used in secondary education, describes their instructional capability, and provides estimated costs incurred with their utilization. Under the guidance of Project CASE's Advisory Board and project staff a prototype manufacturer's survey instrument was developed and pilot tested with representatives from several computer firms. Their comments and suggestions guided the final revision of the instrument. The reader is referred to Appendix B to review the Computer Manufacturer's Survey and the findings of the study. The data are reported as received from respondents and includes not only a description of computer systems used for secondary schools but also manufacturers' views on the current problems and the future of computer-based education in secondary schools.

A third amplification task involved identifying secondary schools that are currently using computer technology in an innovative fashion. Drawing upon a variety of sources such as professional organizations (AEDS--The Association for Educational Data Systems, NAUCAL--National Association of Users of Computer Applications for Learning, AERA--American Educational Research Association, ACM--Association for Computing Machinery, etc.), personal contacts, and discussions with computer users at the secondary level, nominations for innovative programs were solicited. Individual schools nominated by experts in the field were then requested by correspondence to briefly describe their specific computer applications. The response to both the solicitation for nominations and invitations to schools to describe their program was considerable. Several of the more interesting and promising school applications are discussed as exemplary material in

the section of this report summarizing the instructional applications reported by secondary schools responding to the Project CASE survey.

Thus these three studies taken in combination serve to amplify the statistical findings of the school survey by providing a more meaningful and more complete picture of instructional computing at the secondary school level. In this way it is hoped that this study not only depicts the direction and magnitude of secondary school computing, but also captures the spirit and the quality of effort that seems to permeate education's attempts to discover the most effective and creative means of applying computer technology to the teaching-learning process.

GENERAL RESEARCH RESULTS

Overview

Since 1970 computing in secondary education has steadily increased with 58.2 percent of the schools responding to Project CASE survey indicating they are currently using a computer for administrative or instructional purposes (Table 1). This level of school use represents a growth of 23.8 percent since 1970 when only 34.4 percent of the schools reported some type of computer application.

TABLE 1

COMPARISON OF COMPUTER USE LEVELS
IN SECONDARY EDUCATION
1970 to 1975

TYPE OF USE	1970	1975
For administrative only	21.5%	31.5%
For instructional only	3.9	4.9
For both administrative and instructional use	9.0	21.8
Schools Using Computers	34.4	58.2
Nonuser Schools	65.6	41.8
Total	100.0%	100.0%

In reviewing the 1975 data by type of computer application, it can be seen that 31.5 percent of respondents employed the computer only for administrative purposes, 4.9 percent only for instructional purposes, and 21.8 percent of responding schools reported both an administrative and an instructional application. The reader is reminded that this latter category of use includes schools that reported both a computer-based administrative

application (i.e., payroll) and a computer-based instructional application (i.e., CAI math). This category of use is distinct from the two previous categories in that it does not include schools that used the computer only for administrative or only for instructional purposes.

Comparable figures from AIR's 1970 survey reveal the relative growth of computing in secondary education. As shown, administrative computing has increased by 10 percent from 21.5 percent in 1970 to 31.5 percent in 1975, instructional computing has increased by 1 percent, while combined administrative and instructional use has increased from 9.0 percent to 21.8 percent. Thus, while the number of schools using a computer only for administrative purposes still appears the dominant application in 1975, the number of schools which are using the computer for both administrative and instructional purposes is on the increase.

The relative increase of schools using the computer for both an administrative and instructional application is more clearly shown by an analysis of the type of computer use reported only within user schools. For example (Table 2), of all the user schools participating in the 1970 study 62.5 percent reported that they employed the computer only for administrative purposes, while in 1975, 54.1 percent of the user schools employed the computer strictly for administrative purposes. Likewise, the percent of user schools using the computer strictly for instructional purposes has declined since 1970. In 1970, 11.3 percent of the user schools employed the computer only for instructional purposes while in 1975 the number of user schools with only an instructional application dropped to 8.4 percent. In contrast to these findings the number of schools using the computer for both an administrative and instructional purpose in 1975 has increased. That is, in 1970, 26.2 percent of the user schools reported dual applications, while in 1975, 37.5 percent of the user schools reported that they used a computer for both an administrative and an instructional purpose. Apparently secondary education is finding that computer technology can be useful, not only for managing the operation of the school but also for facilitating and enriching the learning process.

TABLE 2

COMPARISON OF COMPUTER USE
IN SECONDARY EDUCATION
(User Schools Only)
1970 to 1975

TYPE OF USE	1970 Magnitude of Use	1975 Magnitude of Use
Administrative only	62.5%	54.1%
Instructional only	11.3	8.4
Both administrative and instructional	26.2	37.5
Total	100.0%	100.0%

Growth of Total School Computing

Another useful index of the growth of computing at the secondary level is by comparing the number of schools using the computer for some type of administrative application with the number of schools having some type of instructional application.

When considering the total use of computers by application (Table 3) both total administrative and total instructional applications have risen substantially since 1970. In 1975, 53.3 percent of the responding schools reported some type of administrative application as compared to 30.5 percent in 1970. Also in 1975, 26.7 percent of the schools responding to the survey reported some type of instructional application as compared to 12.9 percent of the schools studied in 1970. Thus, while the predominant computer application within a school system is still for administrative purposes, instructional computing has substantially increased especially when that application is available in conjunction with some type of computer-based administrative capability.

TABLE 3

TOTAL COMPUTER USE

TYPE OF USE	1970	1975
Total administrative use*	30.5%	53.3%
Total instructional use**	12.9	26.7

* From Table 1 [p. 13]
(a) Schools using the computer only for administrative purposes, plus
(b) Schools using the computer for both administrative and instructional purposes
(i.e., 1970 (a) 21.5% + (b) 9.0% = 30.5%
1975 (a) 31.5% + (b) 21.8% = 53.5%

** From Table 1 [p. 13]
(a) Schools using the computer only for instructional purposes, plus
(b) Schools using the computer for both administrative and instructional purposes
(i.e., 1970 (a) 3.9% + (b) 9.0% = 12.9%
1975 (a) 4.9% + (b) 21.8% = 26.7%)

Projections for Secondary School Computing

Given the findings concerning the growth of secondary school computing for the last five years (1970-1975), and with the assumption that the current rate of adoption of computer technology in the schools (4.8 percent/year) will continue, it can be projected that within the next decade every secondary school in the country will have access to a computer system for some type of administrative or instructional application (Table 4). In addition, given the rates of increase for each type of computer application, it would be expected by 1984 that 48.9 percent of secondary schools would be using a computer only for administrative purposes, 6.7 percent only for instructional purposes, and 44.4 percent of secondary schools would have both an administrative and an instructional application. Thus, within less than a decade it can be expected that all secondary schools in the country

will be using a computer within their educational program, and that if these projections hold, using the same rates of increase, it can be expected that over half of public secondary schools will have some type of computer-based instructional application (44.4 percent both administrative and instructional + 6.7 percent instructional only = 51.1 percent).

TABLE 4

PROJECTION FOR SECONDARY SCHOOL COMPUTER APPLICATIONS

EXTENT OF USE	1970	1975	Rate of Increase	1984 Est.
Schools using a computer	34.4%	58.2%	4.8%/yr	100.0%
Nonuser schools	65.6	41.8	----	----

TYPE OF USE	1970	1975	Rate of Increase	1984
Administrative only	21.5%	31.5%	2.0%/yr	48.9%
Instructional only	3.9	4.9	.2%/yr	6.7
Both administrative and instructional use	9.0	21.8	2.6%/yr	44.4

SPECIFIC RESEARCH FINDINGS

Introduction

The specific results of the 1975 survey of Computing Activities in Secondary Education is presented below in the following six sections:

1. Description of computer-based instruction at the secondary school level.
   - Types of computer applications
   - A summary of instructional programming to include specific subject areas, number of students, grade levels, etc.
   - Examples of computer-based instruction
2. Characteristics of schools using computers to include geographic location, enrollment, number of teachers, and type of school program.
3. Current expenditures for computer applications and source of funding.
4. Computers and terminals used by secondary schools.
5. Organizations supporting secondary school applications.
6. Status of program evaluation to include summary of findings, problems encountered, and overall impact of the computer on the educational program.

Since the trend in secondary computing is toward the complimentary use of computers for both administrative and instructional purposes, and since a primary goal of the 1975 survey is to explore the diffusion of computer technology in secondary education, the statistical findings of the survey will be presented for schools reporting some type of computer use to include any instructional or administrative application (i.e., CAI, CMI, student accounting, payroll, etc.). In this way the presentation of results of the survey will be more consistent with current trends and more indicative of the future direction of computer-based education at the secondary school level.

In general, however, the focus of the research is on the instructional applications of the computer. In order to provide both a qualitative as well as a quantitative assessment of instructional computing at the secondary

level, the statistical findings for the school survey are amplified by data from the longitudinal study, the computer manufacturers survey, and the innovative schools study. In this way the reader is provided sufficient background and perspective to interpret the meaning and significance of the statistical findings of the survey.

Consistent with the objective of this study, comparison between the specific findings of the 1970 and 1975 survey are reported when these comparisons reflect changing trends in educational computing since 1970 or when they relate to the future direction of computing in secondary education. In addition, where important differences between user schools and nonuser schools are found these differences are reported to gain a better understanding of the current status and future of computing at the secondary level. The reader is reminded that the number of responses to each item on the questionnaire varied. Some schools responded to all items, while other schools omitted responses to some items. Since this study serves to functionally describe instructional computing at the secondary level, no attempt was made to statistically impute values for missing data based upon a school's response to other potentially correlated items on the survey. As a result the "N", or number of schools responding to each question, will vary from table to table.

A Description of Computer-Based Instruction at the Secondary Level

Types of Computer Applications

As part of the Project CASE survey, principals were requested to describe their school's instructional and administrative use of the computer. As shown by Table 5, respondents indicated that using the computer as a "Problem Solving Tool" and as a subject for "Computer Science" courses were the most frequently utilized instructional applications in secondary education. In both cases over 25 percent of the schools responding to this item reported that the computer was used to either aid students in the arithmetic calculation of problems or as a formal and specialized course of instruction focusing upon the operation and programming of computer systems. Other significant uses listed by respondents included using the computer in gaming and simulation exercises, CAI, and providing

students career and educational information via computer-based guidance and counseling systems. In addition, one of the most frequent written-in computer applications was using the computer to either generate individual test items or to assemble individual test items preprogrammed into the system for use by individual students.

TABLE 5

SPECIFIC TYPE OF CURRENT INSTRUCTIONAL APPLICATIONS: 1970-1975

TYPE OF INSTRUCTIONAL APPLICATION	PERCENT OF RESPONSES 1970 (N=666)	1975 (N=465)
CAI	8.4%	13.8%
Problem Solving	27.4	25.3
Computer Science	29.0	25.8
Computer Managed Instruction	6.1	4.4
Gaming and Simulation	10.6	15.5
Guidance and Counseling	15.8	13.2
Other applications (i.e., test preparation, curriculum development, scoring, analysis and storage of teacher-made tests, recording of mastery objectives, etc.)	2.7	2.0
Total	100.0%	100.0%

In contrast to the 1970 survey, secondary schools have tended to broaden their instructional use of the computer. Though computer science and problem solving are still the most frequently used application (e.g., in 1970 computer science was reported by 29.0 percent of secondary schools and problem solving was found in 27.4 percent of the schools) the level of use of CAI and gaming and simulation have increased substantially. In

1970 only 8.4 percent of the schools reported a CAI application while in 1975, 13.8 percent of the schools have some type of computer-assisted instruction course offering. Likewise, in 1970, 10.6 percent of the responding schools reported the use of gaming and simulation in the classroom while in 1975, 15.5 percent of the schools participating in the study employed this computer application. Comparison of the data for the remaining applications shows a slight decline in the use of the computer for guidance and counseling, and computer-managed instruction. In general, the use of the computer for Problem Solving and in Computer Science still remains the most frequently reported computer application.

In addition to listing their instructional applications, respondents were requested to indicate the type of administrative applications used by the school (Table 6).

TABLE 6

TYPE OF CURRENT ADMINISTRATIVE APPLICATIONS
(N=864)

TYPE OF ADMINISTRATIVE APPLICATION	Percent of Respondents
Student Accounting	38.9%
Resource Management	6.7
Research	.5
Student Accounting and Resource Management	35.5
Student Accounting, Resource Management, and Research	9.5
Student Accounting and Research	1.7
Additional Multiple Applications (i.e., Research and Resource Management; Research, Resource Management, and Library Processing, etc.)	6.4
Other Applications (i.e., Library Processing, School Census Inventory, Vendor Lists, etc.)	.8
Total	100.0%

Considering individual applications and multiple administrative applications, the most frequent single use of the computer (38.9 percent) was for Student Accounting (student schedules, student records, attendance, grades, report cards, etc.) while the most frequent multiple use (35.5 percent) was reported for Student Accounting and Resource Management (e.g., maintaining personnel and financial records, projection of enrollment, transportation schedules, etc.). Since the 1970 survey did not report administrative applications, no comparisons can be reported.

Specific Instructional Subjects Supported by Computers

To further define secondary education's use of the computer for instruction, principals from schools that had instructional applications were requested to describe their specific computer-based instructional programs. For each subject area in which the computer was used, the respondent was to indicate the grade level of the course, the number of classes in that subject area, the number of teachers and students participating in the course, the length of the class (in weeks), the average number of hours of connect time per month (if applicable), the average number of batch jobs per month (if applicable), and the programming language employed for the course.

For the analysis, all computer-based courses reported by principals were classified into one of nine subject areas. The subject areas included Mathematics (Algebra I, II, Geometry, Calculus, Trigonometry, etc.); Computer Science (Computer Programming, Machine Operation, etc.); Science (Biology, Physics, Chemistry, Ecology, etc.); Social Studies (History, Economics, etc.); Business Education; Language (Spanish, Language Arts, Reading); Other Courses (Electronics, Music, Home Economics); Independent Study and Vocational/Educational Guidance.

As shown by Table 7 the course most frequently utilizing a computer was Mathematics. That is, out of the 1459 individual computer-based courses listed by respondents, 43.2 percent were in Mathematics. Other subject areas frequently mentioned were Computer Science courses (21.7 percent) and Science Instruction (16.2 percent). Other subject areas were reported less frequently.

TABLE 7

INSTRUCTIONAL COURSES UTILIZING COMPUTERS
1970 to 1975

SUBJECT AREA	PERCENT OF RESPONSE 1970 (N=1596)	1975 (N=1459)
Math	46.7%	43.2%
Computer Science Courses	14.0	21.7
Science	21.1	16.2
Vocational/Educational Guidance	-- *	5.4
Social Science	3.2	4.3
Business Education	9.4	3.0
Language	2.2	1.9
Miscellaneous Courses	3.4	2.4
Independent Work	-- *	1.9
Total	100.0%	100.0%

*Not reported in 1970

In comparison with the 1970 survey (Table 7), it can be seen that the predominant instructional use of computers in 1975 is still for Mathematics instruction. In reanalyzing the original 1970 survey data to determine the frequency of responses for individual subject areas[1], it was found that in 1970, 46.7 percent of the computer-based courses listed by respondents were in the area of Mathematics, 14.0 percent in Computer Science, and 21.1 percent in Science Instruction. As shown by the results of the 1975 survey, the instructional use of computers has not varied

[1] In 1970 the data was presented (Table 17 - Darby, et al., 1970) in terms of the total number of instructional applications reported by a respondent. That is, if a school reported that it had available computer-assisted instruction in Math, Science, and English, this was tabulated as one (CAI) application and the percentage of appearance of a course of instruction was calculated in terms of the total number of applications. To compare the 1970 data with the 1975 survey results, the original frequencies reported for each subject area were employed (i.e., Math was reported 745 times in 1970) and percentages determined by dividing the frequency of each subject area by the total number of subjects reported (i.e., 1596).

substantially in five years. Though there has been an increase in instructional computing, the introduction of the computer into a school has not substantially affected instruction outside of Math, Science, and Computer Science.

Computer Applications Within Subject Areas

Another indication of the nature of instructional computing at the secondary level is the frequency of specific computer application across subject areas. According to the 1975 survey (Table 8) Computer Assisted Instruction was most frequently used in the field of Mathematics (59.0 percent) and Science (17.6 percent) and to a somewhat less degree for Lanugage instruction (8.1 percent). In general, CAI is not frequently used in the other instructional areas. Likewise, the computer as a tool for problem solving is used most frequently in the subjects of Mathematics (62.3 percent) and Science (27.3 percent) and to a substantially lesser extent in Computer Science (2.7 percent), Business Education (2.9 percent), and Social Science Courses (1.3 percent). As expected, a substantial number of Computer Science applications are directed toward instruction in computer-related Mathematics (29.6 percent).

TABLE 8

TYPE OF COMPUTER APPLICATION BY SUBJECT AREA
1975

	No. of Responses	Math.	Comp. Sci. Courses	Science	Voc/Ed Guid.	Social Science	Bus. Ed.	Lang.	Other	Indep Work	Total
CAI	222	59.0%	3.6%	17.6%	---	3.6%	3.2%	8.1%	4.5%	.4%	100.0%
Problem Solving	445	62.3	2.7	27.3	---	1.3	2.9	.4	2.0	1.1	100.0
Computer Science	432	29.6	61.6	1.6	.7%	.2	4.4	---	.7	1.2	100.0
Gaming Simulation	235	30.6	11.9	26.4	---	17.4	1.7	1.3	4.3	6.4	100.0
CMI	43	48.8	---	16.3	---	16.3	2.3	14.0	2.3	---	100.0
Guidance Counseling	79	---	---	---	96.2	---	---	---	2.5	1.3	100.0

The only variation in the dominance of Math and Science is when the computer is used for Gaming and Simulation and Computer Managed Instruction. For these applications the use of the computer is frequently reported for Social Science courses as well as Math and Science. For example, 17.4 percent of the courses using Gaming and Simulation techniques are within the area of Social Science, and 16.3 percent of the CMI applications are for this same subject area. CMI is also used for Language Instruction (14.0 percent).

As evidenced by these findings, computer-based instruction primarily supports Math and Science instruction. However, within Gaming and Simulation and CMI applications, the use of the computer is also important to Social Studies and Language instruction.

Comparison with the results of the 1970 survey (Table 9) shows that the use of computers within an instructional program has not significantly changed since the previous study. That is, Math and Science are still the dominant computer-based subject areas, particularly for CAI and Problem-Solving applications. Likewise, Gaming and Simulation and CMI seem to be the applications that more often include other courses such as Social Studies, Business Education, or Language. Some slight differences, however, are noteworthy. First, there has been an increase in Math, Social Science, and Language applications in CAI and Math Problem Solving. Second, Computer Science Programs are including more courses in advanced computer programming, systems design, and fewer courses in mathematics as part of the computer science curriculum. Third, fewer Computer Science courses are presented via a computer-managed application while substantially more Social Science courses are being presented via CMI than was the case in 1970. Finally, there has been a substantial increase in the number of Gaming and Simulation applications in the Sciences and Social Sciences.

TABLE 9

TYPE OF COMPUTER APPLICATION BY SUBJECT AREA
1970*

	No. of Responses	Math.	Comp. Sci. Courses	Science	Social Science	Bus. Ed.	Lang.	Other	Total
CAI	172	54.1%	8.7%	20.9%	1.8%	6.4%	6.4%	1.7%	100.0%
Problem Solving	693	52.1	5.2	28.7	1.2	9.4	.7	2.7	100.0
Computer Science	465	42.4	28.4	13.5	1.1	11.4	.6	2.6	100.0
Gaming/ Simulation	214	34.6	14.5	16.4	13.1	8.9	5.1	7.4	100.0
CMI	14	42.8	21.4	14.3	7.1	---	14.4	---	100.0

*This table was calculated from the frequency of responses for each application and subject area reported in Darby, et al., 1970 - Table 17. For comparison purposes, English and Foreign Language were combined into the Language category; Social Studies and History combined into the Social Science category; and Industrial Arts, Agriculture, Health Safety, and "Other" combined into the Other category. Noncomparable categories (i.e., mediated instruction) or nonreported categories (guidance and counseling, independent work) were excluded.

Grade Levels of Computer-Based Instruction

For most subject areas computer-based instruction was available to students enrolled in grades nine through twelve rather than for students in junior high school (grades seven through nine) or elementary school (grade six and below). This was especially true for the subject areas of Mathematics, Science, Social Science, and Computer Science. Though many schools provided computer-based instruction only for students in the eleventh and twelfth grades, of significance is the fact that the majority of schools reported that their computer-based courses were being offered for students at all secondary grade levels to include the ninth, tenth, eleventh, and twelfth grades.

To illustrate this finding it was found that 68.3 percent of those schools with CAI math applications provided these courses for students in grades nine through twelve, while 82.7 percent of the Problem Solving Math applications, 67.2 percent of Gaming and Simulation Math applications, and 41.2 percent of the CMI Math applications were provided to students in grades nine through twelve. In general, courses in Science, Social Science, and Computer Science showed comparable distributions.

The predominance of computer-based courses at the ninth through twelfth grades was not evident for computer-managed courses. Of significance was that in Math, Science, Language, and Social Science a computer-based course was frequently found at the junior high level as well as the secondary level. For example, 41.2 percent of the CMI Mathematics applications, 50 percent of the CMI Science courses, 40 percent of the CMI Language courses, and 40 percent of the CMI Social Science courses were for students enrolled in the seventh through ninth grades. In addition, a substantial number of these subjects were available to students in both the elementary and secondary grades. That is, 11.0 percent of the CMI Math courses, 16.7 percent of the CMI Science Courses, 20 percent of the CMI Language courses, and 20 percent of the CMI Social Science courses were available to students at the elementary through the secondary level of a school program.

In general, the survey results indicate that computer applications in most subject areas are focused upon the secondary levels of instruction, but that a significant number of courses are being offered to junior high school and elementary school children in conjunction with those schools' secondary educational programs.

In comparison to the 1970 survey, computer applications have remained the domain of secondary education since most computer applications reported by that study were introduced to students in grades nine, ten, eleven, or twelve. However, unlike the 1970 survey, the findings of the current survey indicate a growing number of elementary students participating in computer-based instruction. From the 1975 findings this appears particularly true for computer-managed instructional applications.

Number of Computer Classes by Subject Area

According to the Project CASE survey schools with instructional applications usually made that application available to the majority of students in a specific course of instruction. That is, if there were three sections of twelfth grade Algebra II, then in many schools the computer was available to the students in at least two of the three classes. This finding seems to hold regardless of the specific subject area (i.e., Math, Science, Language, etc.) or computer application (CAI, Problem Solving, Gaming and Simulation, etc.).

For example, for those schools reporting a Math application, a majority of students (i.e., 60 percent or more) were involved in over 93 percent of the CAI Math courses reported by respondents, 65.3 percent of the Problem Solving Math courses, 78.6 percent of the Computer Science Math courses, 66.7 percent of the Gaming and Simulation Math courses, and 40 percent of the CMI Math courses.

For Science courses, comparable levels of student involvement were reported. A majority of students (over 60 percent) were provided computer-based science instruction in 65.7 percent of the CAI Science courses reported, 60.9 percent of the Problem Solving Science courses, 59.9 percent of the Gaming and Simulation Science applications, and 100 percent of the CMI Science classes. Language classes, Social Science classes, Computer Science courses, and Business Education classes report equally high or substantially higher ratios of computer-based classes to total number of classes within a subject area.

In terms of the specific number of classes within a subject area supported by the computer, the survey indicates that for most subject areas and for most applications the number of computer-based classes range from one to three classes. The only exception was for computer-based Mathematics (CAI, CMI, Problem Solving, etc.) which ranges from one to nine or more computer-based classes existing within a school's educational program.

Thus, though the total number of classes employing the computer is relatively small, a high proportion of students enrolled in an academic program supported by a computer do have the opportunity to access the computer as part of that learning experience.

Number of Students Enrolled in Computer-Based Subject Areas

Consistent with the limited number of classes using a computer, the number of students using a computer within a course of instruction is generally small (Table 10). For most subject areas the median number of students enrolled in a computer-based application ranged from 10 to 50 students within each course of instruction. This was true for computer-based courses in Mathematics, Science, Computer Science, Social Science,

Business Education, Independent Work, and courses such as Electronics, Music, etc. The subject area of Language and the Guidance and Counseling application proved to be the exceptions to this finding. Though the number of Language applications reported was small (N=20), over 55 percent of these courses were offered to more than 100 students in the school. Inspection of data concerning the number of students within a specific application (i.e., CAI, CMI, etc.) finds that language courses presented via CAI, CMI, and Gaming and Simulation are most frequently used to reach the largest numbers of students. As with language courses, Guidance and Counseling applications involved 100 students or more with the median number of students accessing a school's computer-based Guidance application being 200 students. In addition it was reported by six schools that their computer-based Guidance application is accessed by more than 1,000 students.

TABLE 10

NUMBER OF STUDENTS BY SUBJECT AREA
(Cumulative Frequency)

SUBJECT AREA	No. of Courses	CUMULATIVE NUMBER OF STUDENTS PER COURSE							
		20 & Under	40 & Under	60 & Under	80 & Under	100 & Under	300 & Under	Over 300	Median
Math	499	26.3%	50.5%	63.9%	72.7%	76.1%	96.3%	100%	30
Science	157	24.2	42.0	57.3	70.7	81.5	97.4	100	50
Language	20	25.0	35.0	40.0	40.0	45.0	80.0	100	200
Social Science	39	17.9	41.0	58.9	61.5	64.1	92.3	100	50
Computer Science	288	50.4	75.4	85.9	92.1	95.2	99.7	100	10
Business Education	28	21.4	50.0	64.3	71.4	75.0	96.4	100	30
Guidance	30	13.3	23.3	26.6	29.9	36.6	66.6	100	200
Independent Work	14	50.0	57.1	78.5	--	92.6	100.0	--	10
Other (Electronics, Music, etc.)	20	45.0	75.0	80.0	85.0	90.0	95.0	100	30

Thus, the number of students accessing a computer for instruction varies in terms of the subject area and to some extent the type of instruction with computer-based courses in Mathematics, Computer Science, Business Education, and special courses such as Electronics, Music, etc. In addition, it is clear that where a computer-based Guidance and Counseling program is available, a large number of students will make use of this resource for gaining information concerning careers, educational opportunities, and vocations.

The Number of Teachers Involved in Computer-Based Instruction Applications

Regardless of the subject area or type of computer application, the number of teachers directly involved in the monitoring, development, or utilization of a computer-based course of instruction was usually limited to one or two instructors. In some courses, however, the number of teachers participating in a computer-based course ranged up to five instructors, with Math courses tending to involve the largest number of teachers per course (the range for Math teacher involvement was 20 teachers). However, in general (that is, for over 83.8 percent of the instructional applications), only one or two teachers were involved.

Course Length

The length of a course using the computer ranged from one week to over a year's instruction (36 weeks). In general 38 percent of the courses ranged in length from 10 to 18 weeks while 44 percent of all courses of instruction ranged in length from 19 to 36 weeks. For the most part, the applications were group-structured programs as opposed to an individualized application and was introduced into the school's curriculum as either a one-semester or two-semester course of study.

Type and Level of Computer Usage

Two data processing modes of computer operation were used by secondary schools for their instructional applications: batch processing and student interactive dialogue with the computer system. Under a batch processing

mode of operation (frequently employed in computer science courses) students prepare their input on cards and submit their card decks to the computer center for processing. Upon completion of the job, the card deck(s) are returned accompanied by an appropriate job listing describing the operation of the job and including any output generated by the program submitted. Often the turnaround time from job submission to job return is overnight though for many schools distant from their computer facilities the turnaround time has been much longer, much to the consternation of the student and his or her instructor. The delay in turnaround time and the difficulties raised by batch processing for learning was frequently identified by respondents as a problem for their school's instructional program. A discussion of this problem as well as others is included in the Evaluation section of this report. Under this mode of computer operation, the frequency of a school's use was the average number of jobs submitted per course per month.

A second mode of computer accessibility is via a terminal, either directly wired to a computer or connected by telephone communication cable. In this mode the student logs on to the computer and directly interacts with the system by answering questions presented by a program, inputting data, changing parameters, doing calculations, etc. For interactive dialogues, the frequency of use is measured in terms of the average amount of time that students were "connected" or logged on to the system. Respondents were asked to submit the average amount of connect time per month used within a subject area utilizing the computer in this mode.

Analysis of survey responses to both of these items found that the primary use of batch processing was for courses in Mathematics and Computer Science, although limited use was also reported for instruction in Science, Language, Social Science, Business Education, and Vocational Guidance. That is out of the 305 individual courses reported using a batch processing mode, 45 percent were reported for Math courses, 33 percent for Computer Science courses, and 11 percent for Science courses. The median number of batch jobs per month reported for each of these subject areas was:

1. Mathematics: Median = 15 batch jobs per month with a range of under ten jobs per month to a high of over 450 jobs on the average submitted during a month;

2. Computer Science: Median = 30 batch jobs per month with a range of under ten jobs per month to a high of over 450 jobs a month;

3. Science: Median = 20 batch jobs per month with a range of under ten jobs per month to a high of 200 jobs per month.

In assessing the type of computer applications using batch processing, it was found that 50 percent of the batch processing in Mathematics and Science was for Problem Solving while 92 percent of the Computer Science batch processing was for regular Computer Science courses such as computer programming, machine operation, system design, etc.

The second mode of computer operation employed by schools was through student interaction with the computer from a terminal with the level of use measured by the average number of connect hours per month accumulated for the course. The courses utilizing this modality were most frequently in the areas of Mathematics, Computer Science, and Science instruction. In total 728 subject areas were reported using the interactive dialogue mode. Of these 44 percent of the courses were in Mathematics, 26 percent in Computer Science, and 16 percent in Science. For these courses the median number of connect hours used for each course was:

1. Mathematics: Median = 15 connect hours per month with student connect time ranging from under ten hours to over 200 student connect hours per course;

2. Computer Science: Median = 35 connect hours per course with the average connect time ranging from under ten hours per month to over 200 hours per month;

3. Science: Median = 15 connect hours per month per course with values also ranging from under ten connect hours to over 200 connect hours per month.

For Language, Social Science, Independent Work, and other courses such as Music, Electronics, Home Economics, etc., the median number of connect hours per month was ten, while the median for Business Education Courses was 15 connect hours per month.

Since the 1970 survey reported only computer running time and did not ask respondents to report the number of batch jobs or connect hours per course, a comparison between the 1970 study and the current study is not possible.

Programming Languages

For each subject area, respondents were asked to indicate which programming language was used for each computer-based course listed. Frequently more than one language was checked for an application, and in fact, 33 individual languages and their combinations were reported by users. These responses would include programming language combinations such as BASIC ; COBOL; FORTRAN; FORTRAN and BASIC; COBOL and PL/1, etc.

Considering the frequency a language was indicated either individually or in combination with other languages, it was found that BASIC was the language most often employed in secondary education's instructional applications (Table 11). As shown, BASIC was the programming language associated with 62.4 percent of the instructional subject areas using a computer. Second in frequency was the FORTRAN language (18.6 percent), and third was the use of the COBOL language (4.6 percent).

To compare the current findings with the 1970 survey, the percent of language usage by subject area was recalculated using the original 1970 data. From the original frequencies, the number of times a program language was associated with a subject area was determined rather than the number of times a program language was associated with a specific application, such as CAI, CMI, etc. Given these recalculations of the original 1970 survey data, comparisons with the 1975 survey are presented. As shown, the use of BASIC for instructional usage has increased substantially from supporting 25.8 percent of the subject area applications in 1970 to supporting 62.4 percent of the subject area applications in 1975. Comparably the use of FORTRAN for instructional applications has declined from 33.6 percent in 1970 to 18.6 percent in 1975.

A review of the 1975 survey findings shows that BASIC was frequently used for Mathematics, Science, and Computer Science courses, while FORTRAN was employed in the areas of Computer Science and Mathematics. For example, of the BASIC applications 30.4 percent of these applications were in Mathematics, 11.3 percent in Science courses, and 11.2 percent in Computer Science courses. Of the FORTRAN applications 7.5 percent supported Mathematics courses while 6.5 percent were for Computer Science courses.

TABLE 11

PROGRAMMING LANGUAGES USED FOR INSTRUCTIONAL APPLICATIONS: A COMPARISON 1970 - 1975

	1970 (N=1387)	1975 (N=1368)
BASIC	25.8%	62.4%
FORTRAN	33.6	18.6
COBOL	3.4	4.6
PL/1	1.6	1.2
COURSEWRITER	--	1.2
ALGOL	1.1	.4
AUTOCODER	3.9	.2
ASSEMBLY	9.1	1.0
APL	1.4	.7
Other (i.e., machine language, NEAT, PAL, POETRY, FOCAL, APL, CARDIAC, GENIE, RPG)	20.1	9.7
	100.0%	100.0%

In general the BASIC language has clearly become the prominent computer language for instructional computing, superceding the use of FORTRAN as the one language most frequently taught to students and as the one language most often supporting a school's instructional application.

Instructional Computing as Shown by the Longitudinal and Innovative School Study

The purpose of the longitudinal study of schools participating in the first AIR school survey was to amplify the results of the current study by exploring with participating schools the problems and progress experienced in their instructional computing over the last five years. Fourteen schools were randomly selected from the list of schools (N=48) visited during AIR's 1970 school survey. Phone calls were placed to the principals of each school selected. Six principals responded to our inquiry and were asked to describe their school's current level of

instructional computing and to contrast their current program with the school's level of computing in 1970. Though several of the principals were recently appointed to their positions, all respondents were sufficiently knowledgeable about the school's program for the last five years. In addition, participants were asked to discuss problems in their programs encountered since the last study and to relate their impressions concerning the impact and future of computer-based education in their own school.

In general the interviews support the statistical findings of the Project CASE survey. For example, one trend indicated in the 1975 survey was the movement of schools toward multiple computer application to include both administrative and instructional uses. This finding was consistent for most schools contacted and particularly true for one principal who reported that in his school students enrolled in the two-year computer science curriculum under the direction of the computer science teacher have primary responsibility for the development and operation of the school's administrative software. In fact, the strategy has proven so successful over the last three years that the school's computer-based administrative capability has been substantially expanded and will include next fall a payroll management program for the entire school system. For these students the training learned in their computer science classes has had immediate and practical application to their school's administrative system to the benefit of both student and school. Apparently administrative computing and instructional computing at the secondary level can complement each other quite well. Another finding consistent with the 1975 survey was that schools with administrative applications tended to improve and expand these applications over the last five years. Where five years ago a school may have had only one application (i.e., class scheduling), today school computing has frequently been expanded to include grade reporting, payroll, budgeting information, and personnel information. For the school administrator the computer has proven to be an invaluable tool that provides relevant information concerning school operation in a timely fashion.

During the last five years the overall level of instructional computing at the secondary level has remained relatively stable with some schools doing less today, some operating at relatively the same level as five years

ago,and some schools doing a little more in instructional computing than was done in 1970. For example, one school has terminated its instructional activity (one terminal time-shared with General Electric Corporation) and is exploring the possibility of accessing the computer system at the University of North Carolina for its students. Another school also terminated its time-share access to the Darmouth system and has instead installed desk top programmable calculators in every math classroom, thus permitting their students quick access to a computational device that effectively weds math theory and the application of mathematical principles. In addition, the school does offer to its business education students hands-on experience with the school system computer that is used for generating student schedules and for monitoring the "instructions by objectives program" operating in the school. The school offers students with sufficient algebra prerequisites to access the computer system for programming and math problem solving. Future growth of instructional computing at the school is assured with the opening of an area Vocational Technical High School which will offer a two-year data processing course of instruction.

Other schools have also improved their instructional computing programs. For example, one school has introduced computer programming experience for students enrolled in the Civil Technology, Architectural Drafting, Metal Technology, and Chemistry programs as well as for problem solving in Math. This increased effort is also reflected in the increased language capability of the system to include BASIC, COBOL, and PL/1 in addition to FORTRAN, and in the purchase of additional computing hardware. As indicated by this principal, instructional computing at his school has increased tenfold since its inception in 1961.

For other schools, instructional computing has been expanded with the addition of gaming and simulation activities in Biology, Science, and Economics and the introduction in one school of an international Social Studies game to be played by high school students and students at the University of North Carolina. In addition, one of the schools had developed and is implementing a computer-based guidance and counseling application for disseminating information on careers and career decision making.

Consistent with the 1975 survey, discussion with participating principals reveal that secondary school computing has survived and in some instances thrived because of the financial support received at the local level. As in 1970, schools in 1975 have turned to their own school boards for the budgeting support needed to continue their instructional computing activities. Though federal monies have been instrumental in assisting schools to initiate a computer application, the current method of distribution (on a project basis) appears to have caused many more problems for a school than warranted. That is, once federal monies are accepted the school system has to assume certain committments to the program that may or may not be fulfilled by local funding at the completion of the federally-funded project. As a result, the governor of one state has decided to reject all federal monies for instructional computing received on a project basis.

Thus, the most prominent problem facing school administrators seems to be the lack of adequate funds to both maintain and improve their instructional computing activities. Given the high costs of CAI and CMI and the budgeting constraints of local funding (the Project CASE survey shows that schools are spending proportionately the same amount on instructional computing today as was spent in 1970--$.002 of every school dollar), school administrators are hardpressed to fund expanded computer efforts. Thus, despite the relative increase of instructional computing at the national level, the growth of instructional computing within a school or school system has been generally limited and is highly dependent upon the financial resources of individual school systems or state departments of education.

Examples of Innovative Instructional Computing at the Secondary School Level

Though the results of the 1975 school survey show that at the national level the use of computers in secondary instruction is primarily limited to Problem Solving and Gaming/Simulation applications in Mathematics and Science, and basic skill instruction in Computer Science, there are many individual secondary schools and school systems that are using the computer in an innovative and comprehensive fashion to both aid and manage their

instructional programs. It is the intent of the amplification study to begin to identify some of these programs in order to more fully capture both the quantity and the quality of effort characteristic of secondary school computing. From the hundreds of school program descriptions that were submitted for review several of the more unusual and perhaps significant examples of school computing activities have been selected and are included below.

The schools presented in this report have not been singled out because they are the only schools in the country developing creative or comprehensive instructional applications. Rather they are representative of the many hundreds of schools which are making important contributions to the progress of secondary school computing. In general the school descriptions are presented as received from the responding school. In those cases where a considerable amount of descriptive material (booklets, professional papers, etc.) was provided, an abstract of the school's (school system's) instructional computing program was developed.

Deerfield High School - Deerfield, Illinois

We lease a Hewlett-Packard Model 30, 9830A, with a card reader and point plotter. Input can be accomplished by keyboard, cards, or magnetic tape, and output modes include a display panel, printer, and plotter. Our unit is housed in a computer lab featuring 2-way intercom and closed-circuit TV to most of our math classrooms. Since the facility is compact, it can also be rolled about to the various classrooms when needed.

Our program is three-fold: (1) to teach detailed computer operation and programming to a select group of students; (2) to expose most of our student body to the basics of computer operation and programming; and (3) to use the computer as a teaching aid to help illustrate concepts in any and all of our departmental courses. We have also made our facility available to teachers in our other departments for grading multiple-choice tests and doing tests and other statistics. But these are incidental uses when compared to the above three objectives, which I will explain more fully here.

1. To accomplish our first objective, we offer a one-semester course in Fundamentals of Digital Computation, M-22, to seniors who have completed at least three years of mathematics. The course of study includes Boolean algebra, the electronic hardware of the computer,

and intensive programming in BASIC, FORTRAN, and machine languages. We have been, over the years, quite pleased with the results of this course. Many who have completed it have gone on to major in Computer Sciences at universities and have selected vocations in this field.

2. Our effort to expose computer use to the majority of our students is accomplished by the inclusion of a two-week computer unit in all of our freshman algebra courses. Students study and program in the BASIC language. The two-week unit includes films on computers, demonstration of programs that correlate with some of the topics they have been studying in algebra, and the chance for every student to get a few "hands-on" minutes to run their own programs or some programs that their teachers have suggested. I have enclosed a copy of the study guides and test that I use for this unit with my algebra classes. Over all, it is one of the most well-received things I do all year in these classes.

3. To illustrate our use of the computer as a teaching aid, I have enclosed a copy of a lesson I use to introduce my classes in Introductory Analysis (a pre-Calculus course) to the concepts in "Limit of a Sequence". In fact, I don't know how I would accomplish any intuitive basis for this work without the availability of the computer. Whether or not my students have had much exposure to computer operations, the BASIC language is so easy, that most of them can readily see what we are accomplishing. Using the computer in this manner can take some of the tedium out of concepts requiring a great deal of computation, like Newton's method, Pascal's Theorem, the Euclidean Algorithm, and many other topics that I cover in advanced classes. My lower level classes can also enjoy checking their homework answers against those of the computer in prime factoring a whole number, finding the values of a polynomial, or finding ordered pairs on a line. The choices are endless here.

Michael L. Doren
Mathematics Department

Alexis I. duPont High School - Greenville, Delaware

As a member of Project DELTA, the Alexis I. duPont High School makes use of computer applications in a variety of ways. Through the guidance department students have access to a massive data bank that can aid them in the selection of prospective colleges. The business education department utilizes CRT units in a series of drill and practice routines for typing students. The primary purpose of this is to develop speed and accuracy in typing for the freshmen and sophomores taking the course. Students may also elect a computer-based algebra course taught with computer programming. In addition, the math department also offers an Introduction to Programming course. Both are open to students of all grade levels although the algebra course is most frequently taken by freshmen and sophomores.

However, the major usage of computer time in our high school is in our ninth grade Introduction to Chemistry and Physics course. One of the difficulties that has always been associated with self-pacing has been the problems created in dealing with large numbers of students individually and at a multitude of levels. The implementation of a computer managed system has eliminated most of these hindrances and freed teachers to work with students on their own.

While the teacher still plays an essential role in the instructional process, he is freed from the clerical and record keeping tasks associated with monitoring student progress. When ready for a quiz on a set of objectives, the student goes to one of the two CRT units located in the room. After feeding in some preliminary information, the computer prints for the student the options he has available at that time. Once the student makes his selection, the machine begins randomly generating a quiz from data banks of questions associated with each objective in that unit. Immediately upon responding, the student is told whether he got the question right or wrong.

In addition to assessing student progress, the utilization of technology has also made it possible for students to receive the type of help in the learning process not usually available. After every quiz, the computer generates for that student an individual assignment designed to help him attain those objectives which he did not understand. These mini-assignments might suggest additional readings, conferences with the instructor, another laboratory experiment or any number of short activities.

One of the greatest assets of this type of approach has been the information provided to the teaching team. Prior to the beginning of a class the instructor can run a short program and receive a printout showing the rate of progress of each student. This can be used to determine priorities for the next instructional segment. After all students have completed a module an analysis of the data can provide the teaching team with the type of information to make a thorough program evaluation.

In general, the CMI approach has permitted us as teachers to more effectively work with students while allowing us to better use our time resources.

Gary E. Dunkleberger
Teacher

Woodrow Wilson High School - San Francisco, California

Woodrow Wilson High School in San Francisco, California has developed a comprehensive vocational education program using computer-assisted instruction. Because of a high absentee and drop-out rate, the program was initiated to improve student attitudes about school and provide career-orientation education.

The first step in the vocational program is spotting potential dropouts. By using a computer program which keeps up-to-date attendance records, counselors can quickly pinpoint students who have been missing classes frequently. These students are given a test based on local industry exams which will help them to realize their employability potential should they actually decide to drop out of school and seek jobs. For instance, if a job requires a score of 75, and a student receives only 50, he can easily see that he has little chance of obtaining the position. Each student then goes through a career selection process followed by a series of specialized business courses, i.e., business math, sales and merchandising, data processing, etc., which is based on his particular career selection. CAI Vocational Math and Vocational English are also a part of most students' coursework. The school also offers other specialized courses in programming, spelling and general problem solving. The program has been quite successful in increasing student motivation and significantly raising math and English skill levels.

In addition to serving the 500 of Wilson's 1500 students who participate in the program, the Hewlett-Packard 2000B computer with its 16 terminals also supports adult school classes and after school classes for elementary and high school students.

Eugene J. Muscat, Ed.D.
Project Director

Grand Forks Public Schools - Grand Forks, North Dakota

Project LOTT (Learner Orientation to Technology) was initiated at the Grand Forks (North Dakota) Public Schools several years ago when the school board decided to provide students and staff with direct experience in computer technology as well as to move toward a more individualized curriculum. Using a DEC 12 with 10 teletypes located in three junior high schools and two senior high schools, individualization is being achieved through the use of learning packages or contracts, CAI program libraries, and a criterion-referenced testing approach to computer managed instruction. The project has been successful in acquainting students with computers, and teachers with CMI, especially in the area of pre-and post-assessment for instructional units or objectives. It has also increased positive student attitudes toward math and education in general.

Grand Forks is also attempting to demonstrate the feasibility of a multi-district centrally-located time-sharing computer facility. Though it has been shown that cooperative utilization of facilities among large school districts is cost-effective, Grand Forks is the first to demonstrate its feasibility among several small school districts which are spread over a large area.

Walt Knipe
Project Director
South Junior High School

Churchill Area High School - Pittsburgh, Pennsylvania

Churchill Area High School in Pittsburgh is a fine example of an extensive multi-application use of the computer. Although the school does not make use of CAI, the computer is used extensively in 45 different subject areas. It is used for such varied courses as math, health, chemistry I, II, psychology, astronomy, physics, probability and statistics, world affairs, and English; computer science classes, for gaming and simulation in an American economics course (The Executive Game - Richard D. Irwin Inc.), in guidance and counseling, and for grading and analyzing tests in many academic areas. Computer managed instruction also plays an important role at Churchill. Many of its 70 teachers rely heavily on the computer for grading and analysis, as is evidenced by the use of CMI in 207 classes in subject areas, such as, world culture, American history, English, G5C5 Biology, algebra, reading, geometry, psychology, and chemistry. Three computers, an IBM 360 and two General Automation computers serve Churchill's 1500 students.

L. Robert McAfods
Coordinator of Data Services

Montgomery County Public Schools - Montgomery County, Maryland

Montgomery County Schools (Maryland) instituted an extensive CAI program in July 1968. The first three years were devoted to training staff, developing curriculum, pilot testing the materials and conducting validation studies. Emphasis since 1971 has been placed on curriculum implementation and related research. Among the goals of the program has been the implementation of more than 40 CAI instructional packages plus CAI reading modules for the elementary grades into the curriculum. Other aims during this phase of the program have been to teach computer literacy, to begin a CMI system at the elementary level and to develop a problem-orientated math curriculum for fourth graders. In addition, Montgomery County has continued to give training to selected staff members and established a resource center furnished with literature on CAI and educational technology. Evaluation also plays an important role in the CAI and CMI programs and is conducted on an ongoing basis.

The program has been visited by over 1,000 educational representatives from across the United States and overseas. These visitors have had the opportunity to observe children at all grade levels using CAI materials.

Catherine E. Morgan,
Director - CAI
William M. Richardson, Ph.D.,
Director, Department of Advance
Planning and Development

Sylmar High School - Sylmar, California

Project CHAT (Communication Heightened Among Teens-Tots) is one of the newer federally-funded computer programs. Based at Sylmar High School in Sylmar, California, the project began in September 1974. It involves a school network of eight elementary and junior high schools linked by a computer housed at Sylmar High. The computer supports classroom instruction in all subject areas and grade levels. Unique to the project is that besides providing basic instruction (BASIC, reading, mathematics) via terminals located within each school, the program will open channels of communication and assistance between students at different schools and at different age levels making possible competitive gaming activities between individuals at different schools and cross age tutoring of younger children by secondary students.

Robert McElwain
Project Coordinator

Jordan School District - Sandy, Utah

The Jordan School District is presently conducting a pilot project using a CMI program termed "TRACER." Presently we are supporting a junior high school science program called Intermediate Science Curriculum Study (ISCS).

The participating teachers played a major role in preparing the ISCS Program for CMI support. The students are responsible for their own data input via optical mark cards and a card reader. Teachers also input data and access information via optical mark cards.

The TRACER program is on a IBM 370/145 computer at the centrally located Division of Data Processing of the Utah State Board of Education. Communication with this computer is accomplished through an in-district communication system for data collection, transmission and reporting. A Datapoint 2200 CRY/mini-computer controls this system and communicates with the large CPU. Communication to the Datapoint 2200 from the school site is accomplished with a Hewlett-Packard card reader and a centronics printer.

The goal of this pilot project is to determine the feasibility of providing low-cost CMI support as a means of facilitating individualization of instruction district-wide.

C. Devon Sanderson
Curriculum Consultant

Niles Township High Schools - (District 219) - Skokie, Illinois

The Niles Township Instruction Computer Program is a vital and far-reaching part of the total instructional approach. The following list itemizes the most evident portions of this program:

- Computer Programming course (1 semester) open to 10th, 11th, and 12th grade students
- An introductory unit taught in all 9th grade Math courses, aimed at providing an awareness of the computer and giving some initial experience in programming in the BASIC language
- Use of data analysis and simulation programs in the Natural Sciences, with the support offered by having mobile terminals that can be brought into the classrooms
- Use of simulations and prepared programs in Social Studies and Business Education
- An extensive system of problem-generators that has been fully developed in Chemistry, Physics, Social Studies, and English Literature; this system is called GENIE and is, so far as I know, unique in its scope and flexibility on any small computer system
- A complete record-keeping system (SPRINT) that enables a teacher to accurately follow a student's progress thru a large number of course objectives
- A complete test-grading system (RAF) used by over 40 teachers in the grading of objective tests; this includes a rather complete test analysis

This entire program is supported by a DEC PDP8/E kept in an office area within the West Division building. This processor supports a network of 7 teletype terminals in 3 buildings, as well as an optical card-reader and line printer. A magnetic disk is used for mass storage and a small tape unit for backup storage. An x-y plotter, attachable to a teletype, is also available for use at a remote terminal site.

The range and depth of the computer applications currently in use in the Niles Township schools clearly put it in the forefront of any schools I am aware of in the metropolitan Chicago area.

Allan H. Paschke
Instructional Computer Coordinator

Jackson Jr. High - Champlin, Minnesota

Our computer and programming instruction is incorporated in our 7th, 8th, and 9th grade curricula as a 1-3 week "unit" rather than offering a "course." We are currently striving to offer a semester course on Computer Science as an elective for next year.

Robert Larson
Educator

Jamesville-DeWitt Central Schools - DeWitt, New York

To overcome the lethargy of teachers and administrators concerning the use of a computer, to promote the proprietorship of math and science utilization, and to promote accessibility to a computing facility, a computer based district wide Evaluation Center was established in 1972 to provide low cost, immediate system support services to the teaching and administrative faculty on a minicomputer as follows:

1. Individual Pupil Achievement Monitoring

   Pretesting, curriculum embedded testing and post-testing of pupils on objective mastery provides teachers with individual pupil profiles as a data base for primary and secondary instructional diagnosis and prescription.

2. Affective Domain Monitoring

   Semantic differential and Q-Sort techniques are utilized to monitor changes in pupil attitude in instructional areas as desired.

3. Automated Prescription Generation

   Items monitoring each objective are designed to identify specific instructional needs from pupil responses. Individual pupil prescriptions are generated from this data base.

4. Interim Progress Reporting

   Instructional progress reports to pupils and parents are generated as desired by teachers.

5. Objective and Item Banking

   Instructional objectives and items to monitor each objective for all courses are edited and revised as needed to update and continually improve the curriculum bank.

6. Test Generation

   Pretest, curriculum embedded tests and post tests are automatically constructed by the computer to each teacher's order from the item bank described in #5.

7. Comprehensive Achievement Monitoring (CAM)

   The effectiveness of the instructional process is assessed for each program as desired through the CAM technology. Selected objectives are monitored regularly to:

   a. provide preinstructional mastery
   b. assess the effectiveness of each learning activity with each objective

c. measure the degree of retention on each objective following instruction
d. identify when reinforcement of any objective is expedient
e. identify interference with an objective if it should occur
f. provide degree of mastery data on any objective upon completion of each instructional program or at any time thereafter.

The services of a professional educational researcher are provided to the teaching staff to assist them in experimental design as it is required to obtain solutions to instructional problems and needs.

The computerized educational support technology has been providing pupil achievement monitoring and other pupil and program evaluation services to other school districts as well as Jamesville-DeWitt. Evaluation design services are also provided to districts not having those skills available through the local staffs.

During 1973-74, ESEA Title III support and local contributions made possible the integration of past research at the Jamesville-DeWitt School District in the process of individualizing instruction with existing management information systems into a comprehensive planning, management and evaluation system (PPBES) for public schools. The system is being field tested in Jamesville-DeWitt. The systems manual for this project will be completed for dissemination by July 1974. Implementation of this educational management system will provide Jamesville-DeWitt and can provide other school districts with:

(1) a data base for decision making.
(2) assessment of educational effectiveness of all programs.
(3) district planning capability based on program evaluation and cost-benefit analysis.
(4) data analysis mechanisms.
(5) more efficient spending through logically determined priorities and the cost-effectiveness studies.

All media to implement these various programs are produced through the systems developed and operating in an Instructional Materials Production (IMP) Center within a Department of Educational Communications (DEC) which services the entire district. In addition, materials required for the in-service training of professional and non-professional staff are being produced through the DEC Center with assistance for the actual in-service training to other school districts provided by staff from both DEC and Evaluation Centers.

Olcott Gardner, Ph.D.
Director of Research

Seattle Public Schools - Seattle, Washington

The need [for a learning management system] became evident as early as 1969 when Seattle's Southeast Education Center schools began to develop and use individualized instruction programs. These particular schools had been designated as the center for research, development, and possible dissemination of innovative programs through a directive by the Seattle school administration to provide individualized programs for all students. Individualized instruction programs adopted or developed by the Southeast Education Center were to meet the learning needs of each student - his pace, learning style, and interests.

Because of the complexities involved in managing this new educational environment, it was evident that technological support systems must be developed simultaneously with the development of educator skills and individualized instruction programs. To bring about the development of the system, an interested educator with the background in application of computer technology was brought in the Department of Planning, Research and Evaluation.

LEARNING MANAGEMENT SYSTEMS REPORTS AND OPERATIONS

The Learning Management System was designed to meet the need for keeping achievement records within individualized instructional programs and to serve as a communication system for teachers, teacher-counselors (an extension of the home room teacher), students, administrators, and parents. Operationally, the process may be described as follows. The information found on achievement records obtained via frequent evaluation of the student against his stated objectives is fed into the computer. From this there are reports produced which go to the teacher, student, and teacher-counselors for each Monday morning's distribution. The reports display three basic kinds of information:

- A listing of the student's achievements for the preceding week includes information about the concept or skill learned, the dates that the student began and completed the task, the media and mode he/she used, the amount of credit earned on the achievement, and the name of the teacher.

- A listing of the student's commitments that have not yet been achieved which are statements of what the student is currently working on and the anticipated completion date. It has much of the detailed information that is available on the achievement statement.

- The summary information is also provided for each student related to credits earned, learning rates, and projections of probable credits to be earned should the student maintain his current learning rate.

Once a month the teachers receive a cumulative report showing the detailed information about all of the student's achievements for the

preceding month. This Monthly Mentor (Teacher) Report becomes a historical file for later reference. At the end of each year, the detailed achievement information is removed from the computer, leaving only the summary information. The summary information is then transferred to the student's transcript where it accumulates through the date of graduation.

Each month a computer-produced Home Report is sent to the pupil's parents. The first part of this report provides parents with information about credits earned, and a statement of the student's credit goal in each subject area. The second part lists information about each achievement for the entire reporting period (month or quarter). These include concepts or skills mastered, amount of credit earned on each achievement, date achieved, and teacher name. During the first year, these reports were sent home quarterly. In the future they will be sent home monthly.

OBJECTIVE TITLE FILE

An additional component of the Learning Management System is an Objective Title File. The file is made up of over 7000 titles. Each title represents a condensed version of a behavioral objective. The actual behavioral objectives exist on learning packages or other management devices. Each title on the file has the following characteristics:

- An objective number is assigned to each title which identifies the discipline, interdisciplinary theme and instructional program that it relates to. Each number relates to a specific behavioral objective.
- Each title is sixty spaces long or less, and includes a verb, an indication of the skill, concept or process required and the criteria of performance when space allows.
- Each (high school) objective is assigned an amount of credit that the student will earn when he masters it. The teacher may override this field when appropriate.
- The cognitive characteristic of each objective is identified.
- Each objective is referenced to a content taxonomy which is unique to the discipline.
- Each objective is referenced to a specific course goal.

The development of the Learning Management System as described has taken three years of design, programming and pilot testing. It is now being implemented in a variety of settings. By September, of this year, it will be in use, to a small degree, in one elementary school, a middle school, a high school, a college teacher training program and an individualized instruction teacher workshop. Although the system is still being refined, its use will be expanded to other programs as soon as teachers and programs are ready. Although the Learning

Management System is only a small part of any instructional program, it is believed that it will provide significant opportunity to improve the quality of decisions that are made at all levels, whether by students, teachers, administrators or parents.

Allan Olson
Specialist,
Learning Management System

Editor's Note: According to Mr. Olson, the Objective Title File has been expanded and is now called the Course Goal Retrieval System. The file includes 16,000 Course Goal Statements for grades K-12 in twelve disciplines. The programming is scheduled for completion by February 1975.

Cincinnati Public Schools - Cincinnati, Ohio

Hardware

The present instructional hardware configuration of Cincinnati Public Schools is:

1	Hewlett-Packard 2000C' with a 23.5 MBYTE Disk and 32 port capacity
1	Hewlett-Packard 2000F with a 23.5 MBYTE Disk and 32 port capacity
6	Infoton CRT's
8	Hazeltine 1000's
1	Hazeltine 2000
2	Texas Instrument thermal terminals
2	Digilog terminals
50	(approx.) Teletype terminals

Software

The following Computer Assisted Instruction Programs are leased from either Hewlett-Packard or Computer Curriculum Corporation.

Reading - Grades 3-6	(CCC)
Math - Grades 1-6	(H.P.)
Adult Reading Skills	(CCC)
Adult Arithmetic Skills	(CCC)
Adult Language Skills	(CCC)
GED Program	(CCC)

In addition, the "Guidance Information System" (GIS) is leased from Time Share Corporation. Although the GIS has been in operation for only 8 months, it has been highly successful.

Perhaps the most innovative and certainly the most exciting projects which are presently under way are the Computer Managed Instruction projects: "Model for Improving Basic Skills" (MIBS) and "Directive Teaching Instructional Management System" (DTIMS).

MIBS is a Title III funder project in which students are inventoried monthly on their progress in math and reading. The inventories are computer scored and feedback to teacher, student and parent is supplied through computer generated reports.

DTIMS is a development of Dr. Thomas Stephens of the Ohio State University which has been in operation in a manual mode for the past year or so. Cincinnati Public Schools is now developing computer software to automate this system.

We are, of course, involved in the less innovative applications such as problem solving, computer programming, on-line attendance and computer simulations (Huntington II).

Robert E. Moore
Computer Applications Specialist

From the MIBS brochure, the Model for Improving Basic Skills provides:

Each child needs a strong foundation in the basic skills.

Each child is capable of learning more than he is now.

Each child has a right to learn at his own pace.

These three beliefs are the basis for the Model for Improving Basic Skills (MIBS). MIBS was designed to enable each child to learn more, to learn at his own rate, and to master the basic skills--reading, language arts, and mathemathics.

MIBS uses educational technology to help the classroom teacher find the competency level of each child, determine his strengths and weaknesses, and provide the appropriate instruction.

The heart of the MIBS project is a series of criterion-referenced tests in each of the subject areas. Criterion-referenced tests measure what a child has already mastered and what he is ready to learn.

We call our criterion-referenced tests "Inventories" because they are used to take stock each month.

Our Inventories itemize a child's progress. The report based on the Inventories compares each month's scores to the previous month's and to the scores at the beginning of the year. In this way every child experiences success--he knows more than he did four weeks ago.

The Model for Improving Basic Skills system is computer-integrated. The computer scores the inventories, updates student files, and supplies reports on each child and each class. When the computer does the paperwork, the teacher has more time to teach.

The computer is more than a super bookkeeper, although it certainly is that, too. At the teacher's request, the computer will tell each child what he should review or study next in a selected concept area of a subject.

Based on the level a child achieves on the Cincinnati Mathematics Inventories, he gets a message from the computer telling him to work on specific types of problems in the area of Sets, Numbers, or Number Theory, or to review types of problems in Addition and Fractions. The messages a child receives from the computer are based on which problems the child answered correctly within each concept area of his most recent inventory.

In addition Cincinnati Public Schools is conducting an experimental CAI program for blind deaf students under an ESSEA Title III grant. From the program's brochure:

This experimental educational program is being conducted within the Cincinnati Public School system and the St. Rita School for the Deaf to design and test possible systems for providing computer assisted drill and practice lessons in language, reading and mathematics in a form best adapted to the special needs of children with visual or hearing impairment.

The specific objectives are:

1. To provide individualized instruction in language, reading and mathematics through the use of computer equipment and programs adapted to the special needs of visually and hearing impaired students.

2. To study the effect of regular drill and practice CAI lessons on the reading and arithmetic achievement of visually and hearing impaired students.

3. To train teachers of blind and deaf students in the use of computer-assisted instruction and in the preparation of lesson material written by teachers for use on the computer by students.

Jack Kennevan
Department of Research & Development

Minnesota Educational Computing Consortium - Lauderdale, Minnesota

From the MECC brochure:

> The "Minnesota Educational Computing Consortium" is an organization formed by a Joint Powers agreement between the Community College System, Department of Administration, Department of Education, State College System and the University of Minnesota System. This agreement permits the new organization (MECC) to have those powers which are common in some degree in each of the Joint Power member systems.
>
> The organization is governed by a sixteen member board appointed by each educational system, the Commission of Administration, and the Governor's Office. The Board determines the policies of MECC with the advisory assistance of an eighteen member MECC Advisory Council, and an Executive Director and staff.
>
> The main objective of MECC is to coordinate and assist in the provision of computing facilities and services which will meet those needs defined by education and are within the appropriation for this purpose. This objective is defined to include making these facilities and services available equally to all students and educational institutions in Minnesota on a real cost basis and at uniform rates. In meeting this objective, it is anticipated private educational institutions will use services of the consortium and will participate fully in the MECC advisory structure.
>
> The rationale for this approach was developed by the logical extension of planning efforts which have gone on over the past several years. Earlier planning reports have stressed the need to view computing and information systems in the context of the complete continuum of educational levels, elementary-secondary, post-secondary, graduate-professional. The need to do this has grown as computers and information systems assume increasingly more significant roles in the processes of educational institutions and education in general. This need for comprehensive planning and sharing of resources by education at all levels has been accentuated further by the growing technological and economic feasibility of communication networks which permit interconnection of computing terminals and facilities throughout the State at a reasonable cost.
>
> The main objective will be met by fulfilling the following specific purposes in serving the member educational systems:
>
> > To ensure effective access by all students and faculty to the computing services required by programs in which the computer needs to be used either as a tool or an object of instruction.
> >
> > To ensure effective access to computing and information services by faculty and students for research, where research is part of the instructional program of an institution.

To ensure effective access to needed computing and information services by faculty and students for purposes of public service, where this function is part of the program of an institution; and to ensure needed access to the public services by the agencies, institutions, and other segments of the public to whom the services are directed.

To assist the systems of education and various coordinating agencies in providing meaningful information to governing boards and to the executive and legislative branches of government to aid them in formulating effective educational policies.

To provide effective management information services, including administrative data processing, for the management of education and educational resources at all levels.

The planning and development of a statewide instructional time-sharing computer network will serve students and faculty throughout the state from all levels of education and permit the sharing and common development of such expensive program packages as computer-assisted instruction. This network will incorporate the services now being provided by other systems such as the Minnesota Educational Regional Interactive Time-Sharing System (MERITSS) serving higher education; the TIES instructional time-sharing services serving several school districts; and the Southern Minnesota Secondary School Computer Project housed at Mankato State College. Training and orientation activities for this network are being planned for the 1973-74 school year with statewide service beginning in September 1974.

Assistance and support for the development of a metropolitan-area management information services center serving the Minneapolis, St. Paul, Robbinsdale, and Mounds View school districts (METRO-II). This center and the operating TIES consortium will serve as prototypes for four additional MIS centers covering the remaining areas of the state. MECC will provide assistance to the other areas of the State as the elementary, secondary, and vocational (EVS) schools begin discussions and planning leading to similar centers in southeast, southwest, northeast, and northwest Minnesota in subsequent years. It is projected METRO-II will be in operation by 1975.

Plans for computing and data processing services and facilities in school districts and post-secondary systems will be reviewed. During the first years of the Consortium, educational institutions will require services which cannot be supplied from MECC. Therefore, MECC has established procedures to review and approve plans for institutionally developed services and facilities. Professional personnel from the member systems representing all levels of education have been made available to MECC through the advisory structure to carry out this review and provide advice and assistance to educational institutions and systems, supplementing their own expertise. The procedure is to have the user

agency's governing system office. The request is then reviewed by the MECC advisory committees and/or the MECC staff to make sure it is compatible with the MECC plan. Once approval has been given, the request can be finalized through open bid procedure.

This plan has been set up to:

(a) assist districts and systems in obtaining the best service at the least cost;
(b) assist in the orderly evolution of MECC by ensuring that developments in individual systems and districts are consistent with overall state plans; and
(c) provide a means for rapid response to the real need of school districts and post-secondary systems.

The development of MECC from its present assisting, review, coordination, and approval position to a position of assuming major responsibility for educational computing services will be determined by several factors. These will include meeting the defined needs of education in the years ahead, the ability of the MECC organization to handle requests and problems in a very professional way with logic and the common good of Minnesota education being the prevailing decision factors.

Dale LaFrenz
Assistant Director

Waterford Mott High School - Pontiac, Michigan

Programs include:

CAI - Reading grades 3-11
CAI - Math grades 2-adult
CAI - English grades 4-12
CAI - Business grades 10-12
CAI - Spelling grades 6-12
CAI - Algebra grades 8-12
CAI - Metric System grades 6-12

Ms. Sue Bila
Operations Manager

Summary

As evidenced by these examples, instructional computing is beginning to productively affect the operation of a school's entire instructional program. Not only are computers useful learning tools for Computer Science, Math, and Science courses, but they also serve numerous other educational functions. For example, computers can provide basic skill instruction in math and reading for students of all ages, including the deaf and the blind; computers can provide essential instruction and guidance support needed for relevant career education; they can facilitate the exchange of knowledge between students at different schools; they can through computer literacy courses introduce all students to computer technology and dispel its black box mythology; and finally they can provide invaluable diagnostic and prescriptive support needed for the management of an individualized course of instruction. Computer-based instruction at the secondary school level appears to be making a major contribution toward improving the quality of secondary education for many schools throughout the country.

For the reader's interest, a brief description of 25 additional, yet equally significant examples of innovative and comprehensive instructional computing at the secondary level are included within Appendix D. Described within this section of the report are the efforts of such schools and school projects as the Philadelphia School System, Memphis School System, Shawnee Public Schools, School District of Kansas City, Project LOCAL, Project TIES, Project PACER, Project LACE, and many others. As indicated before, the schools included within Appendix D simply represent the many hundreds of schools that are significantly contributing to the enhancement of secondary education through instructional computing.

Characteristics of Schools Using Computers

Geographic Distribution

An analysis of the distribution of user schools by geographic region (Figure 1) shows that in general the Northcentral section of the country has a slightly higher level of computing activity than the West, South,

and Northeast.* As indicated 35.2 percent of the schools using computers were located in the Northcentral section of the country, while the remaining user schools were nearly equally distributed over the remaining sections of the country. Specifically the states of Minnesota, Michigan, Iowa, Illinois, and Ohio were particularly active in terms of the numbers of schools that employed computers as part of their educational program either for an administrative or instructional purpose.

Active computing states in other parts of the country include the states of Pennsylvania, New York, and Massachusetts in the Northeast, Texas in the South, and Oregon, Washington, and California in the West.

Comparison of these findings with the 1970 survey shows that while the number of schools involved in secondary school computing has risen substantially, the regions of prominance are still the Northcentral area (35.8 percent of the users in 1970) and the Northeast (26.4 percent of schools using computers in 1970). However, computer activity in the South has increased (particularly in Texas); the number of schools from the South using computers has risen from 15.8 percent in 1970 to 20.3 percent in 1975. Comparison of computing activity in individual states over the last five years finds that the states most active in computing today are the same ones most active in 1970. The only difference is an increase in the number of schools using a computer in the states of Iowa, Texas, and Washington. Thus, while the number of schools in the country using the computer has substantially increased since 1970, the rate of growth across geographic regions remains relatively unchanged with the states most active in 1970 still serving today as the focal point for secondary school computing.

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*The percent of schools included in the sample from each region was the following: (1) Northeast - 912 schools or 16.3 percent; (2) South - 1909 schools or 34.2 percent; (3) Northcentral - 1745 schools or 31.5 percent; (4) West - 878 schools or 15.7 percent; (5) other areas - 136 schools or 2.5 percent.

USER SCHOOLS BY GEOGRAPHIC AREA
(N=1,063 schools)

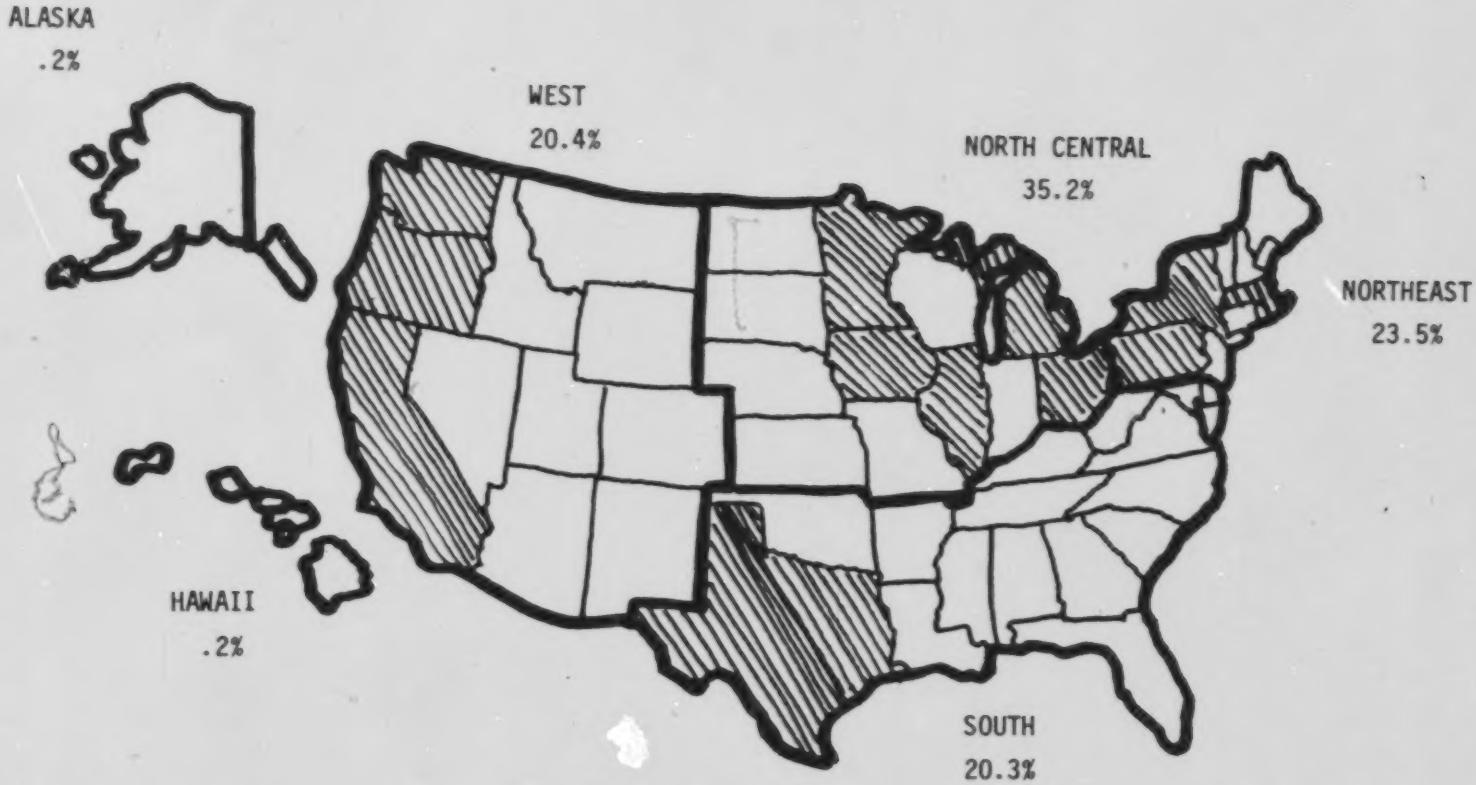

FIGURE 1

School Characteristics of User and Nonuser Schools

In general, schools using computers differed from nonuser schools in terms of the grade levels encompassed by the school's educational program, the number of students, the number of teachers, and the type of instructional program offered students attending the school.

Grade Levels

Schools that used the computer for their educational program most frequently included the grades nine through twelve, ten through twelve, or seven through nine (Table 12), while nonuser schools tended to include a wider range of educational levels. Not only did a substantial number of nonuser schools provide instruction for grades nine through twelve (31.0 percent) but also a high percentage of nonuser schools included both secondary and junior high or elementary grades within their school programs. For example, 18.4 percent of nonuser schools included grades seven through twelve, while 13.8 percent of nonuser schools included grades one through twelve, six through twelve, etc. In essence this finding reflects the fact that secondary schools with an educational program for both secondary and junior high or elementary students tended to be less active in school computing than those secondary schools with primarily a secondary (grades 9-12) or intermediate (grades 7-9) school program.

TABLE 12

GRADE LEVELS OF USER AND NONUSER SCHOOLS

Grade Level Range	Users (N=979)	Nonusers (N=865)
9 - 12	40.6%	31.0%
10 - 12	18.3	7.9
7 - 9	21.5	12.9
7 - 12	8.0	18.4
12 only	3.3	16.0
Mixed (1-12, 6-12, etc)	8.3	13.8
Total	100.0%	100.0%

Number of Students

The median enrollment for user schools was substantially larger than for nonuser schools. As shown (Table 13) the median number of students enrolled in user schools was 1,000, while the median enrollment of nonuser schools was 400 students.

TABLE 13

NUMBER OF STUDENTS IN USER AND NONUSER SCHOOLS

Number of Students	Users (N=980)	Nonusers (N=864)
Under 500	15.4%	56.7%
500 - 999	34.5	28.7
1000 - 1499	23.1	10.0
1500 - 1999	12.2	3.1
2000 - 2499	6.6	1.2
2500 +	8.2	.3
Total	100.0%	100.0%
Median	1000 students	400 students

Number of Teachers

Accordingly the number of teachers employed by user schools was larger than nonuser schools. The median number of teachers employed by user schools was 52 teachers, while the median number of teachers at work in nonuser schools was 25 teachers (Table 14).

Thus schools using a computer tend to be medium size schools that have substantially more students and larger teaching faculties than non-user schools. Obviously the cost of computer-based educational applications is such that only the medium or larger secondary school can justify the investment and afford the expense of providing their student body an enhanced learning experience with computer technology.

TABLE 14

NUMBER OF TEACHERS IN USER AND NONUSER SCHOOLS

Number of Teachers	Users (N=906)	Nonusers (N=836)
20 & under	8.1%	36.3%
21 - 40	26.3	40.9
41 - 60	25.9	14.2
61 - 80	16.2	5.0
81 - 100	11.6	2.1
100 +	11.9	1.5
Total	100.0%	100.0%
Median	52 teachers	25 teachers

Type of Instructional Program

Finally the survey indicates that schools that incorporate a computer into their educational program primarily offer a "Comprehensive" educational program that encompasses the preparation needed by students to enter college or to begin a technical or vocational career (Table 15). In contrast, nonuser schools were nearly equally divided between those schools that offered a strictly Academic program and those schools that are Comprehensive in nature.

Evidently schools that offer to their students a comprehensive education find the computer a useful tool that can assist in meeting the diverse administrative or instructional needs demanded by their multifaced educational programs.

TABLE 15

EDUCATIONAL PROGRAM OF USER AND NONUSER SCHOOLS

Type of School Program	Users (N=977)	Nonusers (N=863)
Academic	27.9%	44.1%
Vocational	2.7	2.0
Comprehensive	68.6	49.5
Other (e.g., school for the deaf, juvenile court school, special ed., etc.)	.8	4.4
Total	100.0%	100.0%

A Comparison of User School Characteristics: 1970-1975

Consistent with the 1970 survey, the current study shows that user schools tend to offer their students a comprehensive education. In 1970, 71.9 percent of user schools were "comprehensive" while in 1975, 68.6 percent of user schools offered a comprehensive curriculum. Unlike the 1970 survey however, user schools in 1975 tended to have lower enrollments (median student enrollment was 1,347 students in 1970 and 1,000 students in 1975) and smaller teaching staffs (median teaching staff was 69 in 1970 and 52 in 1975) than those user schools participating in the 1970 study. In addition, the 1975 user schools tend to include more junior high schools than reported in the previous study (13.0 percent - 1970 and 21.5 percent - 1975).

However, it should be noted that the 1970-1975 comparison must be tempered with the fact that the 1970 study considered a "user school" as one with some type of instructional application, either alone or in combination with an administrative application, while the 1975 study also includes in the user category schools that employed the computer only for administrative purposes. The 1970 survey found that instructional user schools tended to be larger than noninstructional user schools. As reported by the study, this latter category included both administrative only

and nonuser schools. The medians for enrollment and size of faculty reported in 1970 were:

Instructional Users	Other (Administrative Only User Schools and Nonuser Schools)
1347 students	636 students
69 teachers	34 teachers

Thus, it appears that since 1970 computer technology has made its way into the educational program of slightly smaller schools and lower grade levels than was the case five years ago. The differences, however, are small and seen at this time only to be indicative of a potential trend that may blossom over the next five years of secondary education's experience with computer technology.

Levels and Source of Funding

Levels of Funding

The Project CASE questionnaire requested principals to provide their school's total annual operational budget and their annual budgets for instructional and administrative computing. In the hopes of obtaining accurate cost estimates from respondents, principals were requested to check [✓] NA for this question if the information was not available to them rather than attempt to provide inaccurate cost estimates. Given these responses, it was found that the median expenditure for instructional computing in a school was $3,325 (N=192 schools), while the median expenditure for administrative computing was $3,983 (N=302 schools). With a median total school budget of $1,763,388 (N=303 schools), roughly .18 percent of the total budget was allocated for instructional computing while .22 percent was allocated for administrative computing.

As a result of the Superintendent's mailing, 50 school systems also provided budget data for their school system's use of the computer for administrative and instructional purposes. These findings amplify and support the cost data provided by the principal survey.

For school systems responding to the survey, the median instructional computing budget was $25,000 while the median administrative computing

budget was $7,750. Given a median total budget of $4 million, the administrative computing budget represented .2 percent of the total operating budget, while the instructional computing budget represented .6 percent of the school system's total operating budget. Based upon these findings, it can be expected that in general a school system would expend anywhere from $0.40 (principal's survey) to $0.80 (superintendent's survey) of every 100 school dollars on some type of computing expenditure. Likewise, it can be expected that a school or school system would expend anywhere from $0.18 (principal's survey) to $0.60 (superintendent's survey) of every 100 school dollars on some type of instructional computing.

These findings are comparable to those reported by the 1970 survey. According to that report out of every 100 educational dollars budgeted by a school for total operating expenses, approximately $0.17 was spent for instructional computing. Thus, over the last five years the level of funding invested by a school in its instructional computing program has remained relatively unchanged.

Source of Funding

As with the 1970 survey the most prominent source of funding for computer-based education was from local sources. As shown from Table 16, local support was the only source of funding mentioned by 70.4 percent of the schools with administrative computer applications and 63.3 percent of the schools with instructional applications. By combining all categories of funding sources that include some local funding for instructional computer application, over 90 percent of the user schools that have an instructional application report partial or total reliance on local funding for support.

TABLE 16

FREQUENCY OF FUNDING SOURCES
FOR COMPUTER APPLICATIONS (N = 394 Schools)

Source of Funding	Type of Application (Percent of Respondents) Administrative	Instructional
Local	70.4%	63.3%
State	2.6	1.8
Federal (NSF, OE, other Federal)	1.1	3.1
Local and State	19.6	21.6
Local and Federal	1.1	4.9
Local, State, and Federal	2.0	1.0
Various combinations (i.e., Local, State, and Title III; Local, State, and Private Foundations, etc.)	1.3	1.2
Other	1.9	3.1
Total	100.0%	100.0%

In terms of the amount of dollars provided by each funding source, the median percent of funds received by user schools from local sources for both administrative and instructional applications was 100 percent. However, the mean level of funding by funding sources shows that the average amount of funding from local sources for Administrative applications was 82.4 percent and 77.5 percent for Instructional applications. Of interest is that state funding was an important secondary source of revenue for both types of applications (12.7 percent - Administrative and 12.5 percent - Instructional). In addition, the next highest budget contribution to Instructional computing was from Title III funds which provided an average of 3.4 percent of the computer dollars for schools with instructional applications.

These latter figures are comparable to the 80.3 percent levels of funding for instructional computing from local sources reported in the 1970 study. In contrast to 1975, however, the 1970 survey showed that state, federal, and other sources contributed 5.1 percent, 6.7 percent, 7.9 percent respectively, to instructional budgets while in 1975 state funding was the second most important contributor to instructional computing activities.

Computer Systems Used by Secondary Education

Types of Computers

School respondents were requested to list each computer their school used and to indicate its main storage capacity in characters, the type and number of terminals, the arrangement for the computer's use (own, lease, etc.), and the organization or institution that supported the computer accessed by the school. In response to this series of questions, it was found that of the 481 user schools providing this information, 73 percent had access to only one computer, 19 percent had access to two computers, and 8 percent of the respondents used three different computer systems.

Of the computers listed (Table 17), IBM computers were the most frequently reported computing systems used by secondary schools (39.6 percent) while Hewlett-Packard (11.2 percent) and Digital Equipment Corporation (8.6 percent) were cited second and third. The category of Programmable Calculators was ranked fourth on the list of computers employed by secondary education. For this study a computer was defined as "a machine that operated under the control of a stored program," and included programmable desk top calculators that operate with stored instructions which could be programmed.

TABLE 17

COMPUTERS USED BY SECONDARY EDUCATION
(N = 659 Computers)

Type of Computer	Percent of Respondents
IBM	39.6%
Hewlett-Packard	11.2
DEC	8.6
Programmable Calculators (i.e., Monroe, Educator, Olivetti, etc.)	6.7
Honeywell	6.2
Burroughs	5.2
NCR	4.4
UNIVAC	3.2
CDC	2.9
Data General	1.4
WANG	1.4
RCA	.6
G.E.	.6
Xerox	.3
Others (Litton ABS, Seiko, Fisher, Bell, etc.)	4.5
Computer Service Provided	3.2
Total	100.0%

Size of Computer

Beside providing the name of the computer(s) used by the school, respondents were also asked to indicate the size of their computer in terms of main memory. As shown (Table 18) the size of computers within secondary schools varies considerably from the mini systems with 8, 12, and 16K characters of storage to the larger systems with over 300K characters of storage. Of the systems listed, the most frequently mentioned size was 32K of storage with 8K systems listed second and 64K systems listed third. Evidently the growth of computing at the secondary level is occurring over the spectrum of computers available on the market to include the mini system as well as the maxi systems.

TABLE 18

STORAGE CAPACITY - MAIN MEMORY IN CHARACTERS
(N = 304 Computers)

Storage (K)	Percent of Respondents
1 - 10	19.4%
11 - 20	16.1
21 - 50	20.0
51 - 100	17.8
101 - 300	18.8
300 +	7.9
Total	100.0%

It would appear from the amplification study (particularly the manufacturer's survey) that the availability of smaller computers at lower costs for educational purposes have certainly increased over the last five years and that their availability has effected to some degree the use of computers at the secondary level. However, since AIR's previous study did not identify the size of computers used by secondary schools in 1970, the exact degree of this impact cannot be determined. From the response to the Manufacturer's Survey (Appendix B) it would appear that most manufacturers are attempting to provide a full range of computers in hopes of capturing some share of the secondary school computer market.

Terminals

In addition to listing the type of computer, respondents were asked to list the type and number of terminals that were utilized with each computer. As shown by Table 19 the most frequently mentioned type of terminal was the teletype unit (37.9 percent of the terminals listed). In completing this item, many respondents simply described the terminal they used as a "teletype" without indicating a manufacturer's name or model. Other

respondents provided a manufacturer's name without indicating the unit's model type. The categorization provided by Table 19 reflects this response pattern in that the category "Teletype" includes all responses that indicated a teletype unit with or without a manufacturer's label, while the remaining categories include the schools that simply responded with a manufacturer's name. Inspection of the listing of teletypes finds that 54 percent of those reported by schools were ASR 33s. Other manufacturers reported by schools included UNIVAC, Hewlett-Packard, Data Products, and Bell Systems.

TABLE 19

TYPES OF TERMINALS USED BY SECONDARY SCHOOLS
(N = 311 Terminals)

Type of Terminal	Percent of All Terminals
Teletype	*37.9%
IBM	13.5
DEC	5.1
Western Union	3.9
Hazeltine	2.9
Texas Instruments	2.6
Remion	1.9
Olivetti	1.9
G.E.	1.9
RCA	1.6
Burroughs	1.6
Others	25.2
Total	100.0%

*54 percent of teletypes reported were Model ASR 33s

Number of Terminals

In general schools had few terminals available for their use. The median number of terminals per school (N=215 schools) was two terminals (1.94 terminals) while the mean number was five terminals per school (4.9 terminals). The mode or most frequently cited number of terminals reported by an individual school was only one terminal. The reader is referred to the evaluation section of this report for a discussion of the problems faced by educational systems that only have access to one terminal per school. The administrative bottleneck caused by a lack of terminals appears to be the single most frequently mentioned concern of school staffs currently using a computer to aid their instructional program.

Accessibility of Computer Systems Used by Secondary Schools

The Project CASE survey indicates (Table 20) that a substantial number of schools (33.9 percent) access a computer by purchasing time from an outside source, such as a computer network, school system, college, or university, while a nearly equal number of schools (30.5 percent) have access to a computer through lease arrangements with a computer manufacturer. In addition, a large percentage of schools (23.2 percent) are using computers they have purchased.

These findings are comparable to the 1970 survey. The results of AIR's previous study showed that 37.2 percent of the schools leased their computer system, while 34.2 percent purchased time. Of significance is the increased number of schools currently owning their own computer. In 1970, 17.9 percent of the participating schools owned their computer while in 1975, 23.2 percent of the schools in the study were using a computer they had purchased for school operations. Though several explanations on this shift could be proposed, one possible reason for the increase in computer ownership may be because of the increase of mini computers and programmable desk top calculators purchased by schools for instructional or administrative applications. Since mini computers are frequently purchased rather than leased and, because mini computers provide limited storage, this finding, combined with the fact that 35.5 percent

of the computers used by secondary schools have main storage capacites of 20K characters or less (Table 18), give some indication of the growth of mini computers in secondary education.

TABLE 20

ARRANGEMENT FOR SCHOOL USE OF A COMPUTER:
1970 - 1975

Type of Computer Arrangement	Percent of REspondents 1970 (N=652)	1975 (N-853)
Time Purchases	34.2%	33.9%
Computer Leased	37.2	30.5
Computer Owned	17.9	23.2
Time Donated	10.7	7.8
Own and Lease	-- *	1.7
Time Purchased and Donated	-- *	1.1
Other Arrangements (lease-time purchased and donated, own and time purchased; lease and time donated; etc.)	-- *	1.8
Total	100.0%	100.0%

*Not reported in 1970

Consistent with the finding that individual schools for the most part purchase time or lease their computer system, the Project CASE survey indicates that 43.3 percent of the responding schools look to either the school itself or the school system for direct access to a computer system (Table 21). Other organizations supporting a school's computing activity are regional computer consortiums, commercial firms, and colleges and universities.

TABLE 21

ORGANIZATION(S) PROVIDING THE SCHOOL'S COMPUTER(S)
(N = 674 Responses)

Organizations	Percent of Respondents
School or School System	43.4%
Regional Computer Consortium	18.6
Commercial Firm	14.7
College or University	10.8
Multiple organizations (i.e., school, consortiums, and commercial firm; college and consortium; etc)	4.5
Other	8.0
Total	100.0%

In essence, the survey indicates that there are a variety of resources and support organizations available to secondary schools interested in introducing computer technology into their school programs, but that for the most part, schools look to their own school system for the technical skills and hardware necessary for the administrative or instructional use of the computer.

Computer Manufacturer's Survey

To amplify the survey findings concerning computer hardware used by schools, a Computer Manufacturer's Survey was conducted. This study provides a qualitative complement to the statistical findings of the Project CASE survey by illustrating several of the more prominent computer systems that are currently being used by secondary schools.

The Computer Manufacturer's Survey (Appendix B) was mailed to over 80 computer hardware manufacturers (main frame) in the United States as identified by Datapro's Directory of Suppliers (Datapro Research Corporation, 1974). Each manufacturer was asked to indicate whether they currently

had secondary school customers and to briefly describe the type(s) of computer products marketed by their firm in secondary schools. In addition, they were requested to describe three computer systems currently in use at the secondary level. The description included the name and location of the school, the number of students, the administrative and/or instructional function of the system, hardware configuration, software/courseware in use, programming language(s), and hardware and software/courseware costs. Lastly, the manufacturer was asked to indicate and comment upon any major problems encountered by the computing industry in assisting secondary schools to use computers and to describe in their opinion the major thrust of computer-based secondary education today and the trends in the computer industry relevant to the secondary school marketplace. The letter accompanying the survey form indicated that survey responses would be reported as submitted. Completed surveys were received from Burroughs Corporation, Digital Equipment Corporation, Hewlett-Packard Company, Control Data Corporation, and Interdata Corporation. The information provided by the survey includes example computer systems as well as personal and corporate views on the problems and progress of secondary school computing. In general computer manufacturers see the secondary school market as a promising one that offers potential for growth and deserving of more careful attention by manufacturers. However, the development of this marketplace according to the manufacturers depends in part on the willingness of the educator to assume some of the responsibility for improving the profit potential of a company's investment in this area. Some of the problems mentioned were the lack of customer sophistication in computer systems, the development by school personnel of more open and honest interactions with computer representatives, and the problems of limited school budgets for equipment purchased. Significant trends in secondary school computing submitted by the manufacturers include the movement toward single multi-use computer systems suitable for both administrative and instructional applications; increased administrative applications and growth of instructional computing involving problem solving, computer appreciation, and computer-assisted instruction; increased interest in distributed computing by making computer services available to many secondary schools from one centralized source; and, the better utilization of communications media needed to access computer systems that schools cannot afford to buy or

lease. The reader is referred to Appendix B for the description of the computer systems submitted by computer manufacturers and for their specific opinions and comments concerning the problems and future of computer-based secondary education.

Support Organizations

As alluded to earlier in this report, a secondary school's use of computer technology does not occur independently, but instead with the assistance of a variety of organizations, institutions, and commercial firms. To gain some insight into the multifaceted nature of a school's use of computer technology, respondents to the Project CASE questionnaire were asked to describe the organizations that assisted their own instructional computing program in a nonfinancial capacity by sharing their expertise and computing resources. The types of assistance provided include Data Processing staff acting as resources; facilities' computer time donated; use of consultants; timesharing; consultant's newsletter; sharing of facilities and program libraries; software; documentation; training; advisory staff consultation; information and curriculum exchange; statewide staff development; instruction for teachers; and finally, advice. Schools were asked to list those computer networks, colleges and universities, and manufacturers that assisted them for each of their instructional applications to include CAI, Problem Solving, Teaching Computer Science, Gaming/Simulation, CMI, and Guidance and Counseling.

As shown by Table 22 secondary schools have found that nonfinancial support for their instructional computing efforts can be obtained from a variety of organizations involved in computer-based instruction. Tabulation of survey responses indicates that the one most prominent source of nonfinancial technical support is the Computer Network. As shown, this support tends to be available for all types of computer applications from CAI through Guidance and Counseling.

In the case of CAI, 30.4 percent of the responding schools looked to the Computer Network for nonfinancial support while only 10.1 percent of these schools looked to a college, and 7.6 percent sought support from computer manufacturers. The Computer Network's contribution to secondary

school computing is in evidence for the other applications as well. For example, of the schools with a problem solving application who received some sort of nonfinancial assistance, 24.6 percent received support from Computer Networks, while 23.4 percent of the schools received help from networks in Computer Science, 24.7 percent in Gaming/Simulations, 45.9 percent for CMI, and 51.1 percent for Guidance and Counseling applications. Likewise Computer Networks played a prominent contributory role for schools that sought assistance from more than one organization. For example, 15.2 percent of the schools with a CAI instructional application looked to Computer Networks and a college or university for programming support, information, or advice.

TABLE 22

ORGANIZATIONS PROVIDING COOPERATIVE SUPPORT AND SERVICES TO SECONDARY SCHOOL COMPUTING

Type of Organization	CAI	Problem Solving	Computer Science	Gaming/ Stimulation	CMI	Guidance and Counseling
No. of Schools	79	118	150	93	24	47
Computer Networks with other schools	30.4%	24.6%	23.4%	24.7%	45.9%	51.1%
Colleges/Universities	10.1	16.9	19.3	14.0	12.5	8.5
Manufacturers	7.6	11.9	11.3	7.5	--	10.6
Computer Networks, Educational Institutions, and Manufacturers	12.6	8.5	4.7	4.3	8.3	4.3
Computer Networks and Educational Institutions	15.2	10.2	11.3	15.1	8.3	10.6
Computer Networks and Manufacturers	8.9	5.9	4.7	6.4	12.5	4.3
Educational Institutions and Manufacturers	7.6	9.3	9.3	8.6	4.2	--
Other Combinations	7.6	12.7	16.0	19.4	8.3	10.6
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

The findings of the 1975 survey are in contrast to those reported in 1970. From interviews conducted with teachers in schools using the computer for instruction it was found in 1970 that only 18 percent of the participating schools belonged to any formal computer network, either in the form of an

association with a computer complex (e.g., Project LOCAL, TIES, DECUS, etc.) or in terms of groups sharing information about computer applications. However, over 75 percent of the respondents expressed that they did on occasion cooperate on an informal basis with other agencies, share course materials, seek advice, conduct site visits, visit other schools, and in one instance write a joint proposal for funding their computer program.

Evidently over the last five years schools have found it necessary and productive to make better use of existing resources in a more formal and cooperative way. In essence, the growth of computer technology in the schools as evidenced by the Project CASE survey may have been partially advanced by the service provided by these many organizations which are making computer technology a reality for many individual schools.

To illustrate the extent of this cooperative effort, the organizations, institutions, and commercial firms, etc. that were listed by respondents as those providing productive assistance to their school have been tabulated and are presented in Appendix C, entitled "Organizations Cooperating in Secondary School Computing."

Since the sharing of facilities, resources, etc. frequently occurs between a school and an institution within the same state, the individual organizations have been classified by state and by the instructional application they support. With this summary of cooperative organizations, the reader will be able to identify networks, schools, colleges, and commercial firms within a geographic region that are currently assisting secondary school instructional computing.

Assessment of Instructional Computing at the Secondary Level

Status of Program Evaluation

Principals of schools with instructional application were asked to provide an assessment of their school's instructional computing program. Respondents were requested (1) to indicate whether a formal evaluation had been conducted; (2) to summarize the findings of the study, if completed; (3) to discuss any problems encountered in the school's instructional

application(s); and (4) to describe how the use of the computer had affected the overall instructional program.

Despite the current emphasis in education on evaluation and a greater awareness of the "accountability of the educator," few schools have formally evaluated their instructional computer-based program. In fact, (Table 23) 71.5 percent of the schools have not evaluated their computer-based instructional program, while only 12 percent have conducted some type of assessment. Of interest, however, is that 16 percent of the schools did report evaluations were currently in progress in their schools.

TABLE 23

STATUS OF PROGRAM

EVALUATION OF SCHOOLS' INSTRUCTIONAL COMPUTER APPLICATION

(N - 375 Schools)

Status of Evaluation	Percent of Respondents
The program has been evaluated	12.0%
The program has not been evaluated	71.5
The evaluation is in progress	16.0
The status of an evaluation is not known	0.5

In general respondents (whether they had conducted a formal evaluation or not) considered that their instructional computer applications were beneficial to the courses where used, particularly in math and science, and for many the introduction of the computer has had beneficial impact on the entire instructional program. As one respondent indicated: "Particularly in math and science, the applications have grown to a truly

indispensible point, where the computer has become a used and useful tool in augmenting, enriching, and implementing tne curriculum."

Evaluative remarks concerning the use of the computer in the classroom submitted by principals were collated on over 30 typewritten pages. Seven topics were of major concern. They included (1) student motivation; (2) student achievement; (3) teacher reactions; (4) the management of instruction; (5) new curriculum; (6) the problem of accessibility; and (7) instructional materials.

Student Motivation

As was the case in 1970, the findings of the 1975 survey clearly show that students who have the opportunity to use the computer to aid, augment, or enrich their learning experience have noticeably higher levels of motivation toward their subjects (particularly in math and science) after the introduction of the computer into the classroom. As one principal indicates: "Our computer terminal has revived the scholastic interest of some students that seemed to have lost interest in learning. It has been very beneficial to advanced math and science students by eliminating dull calculations and by opening new avenues of learning and curiosity. It has provided a limited but secondary method of review and practice of items not fully mastered in the classroom. It provides, in certain subjects, a self-diagnosis of achievement difficulties. Simulations have enabled the student to learn by his own choices, experiences, and decisions. Our terminal also serves as a much needed tool for our data processing course which in the past was accomplished by batch processing and field trips."

In general, respondents felt that the computer in the classroom has turned on a lot of turned-off students in mathematics while at the same time providing much needed instruction for slow students and a challenge to faster students. The computer in the classroom increases student interest, enriches existing programs, and motivates students at all levels. With the aid of the computer, students tend to do extra work in math and in their science courses. Apparently educators have found that the computer is highly effective not only as an enrichment activity for gifted students, but also for those students of average and below average ability who want to successfully master mathematical concepts. From the student's

point of view, the advent of the computer in the classroom has been a highly acclaimed success.

Student Achievement

Beside increasing student motivation for math and science, computers in the classroom have yielded gains in student achievement. One principal stated that students in computer-based algebra classes scored 11 times better than the students in the regular algebra classes when measured by the improvement in math scores from pretest to posttest. Another principal reports that the computer has improved the academic quality of the instruction by expanding the scope of courses, by allowing teachers to handle a larger number of students and by permitting more indepth and creative student projects. Though the last chapter on the effects of computer-based instruction on achievement has yet to be written, the principals responding to the Project CASE survey felt that the computer in the classroom has greatly improved the math and science achievement of their students and that students tend to learn more rapidly when provided direct experience in programming and machine operation.

Teacher Reactions

Principal comments related to teacher reaction to the computer in the classroom were considerably less frequent than those citing effects on students. In general, these comments tended to reflect that many teachers seem to passively accept the existence of the computer but as yet have been reluctant or unable to utilize the computer within their own classes. These reports are mixed, however, for while one principal states that his teachers haven't been changed by the availability of computer, in another school the presence of the computer has made the staff more aware of various approaches to teaching beside the one they are using in the classroom.

One response from a teacher indicates his mixed feelings toward computers in the classroom when he says: "A few students become computer bugs. They spend a great deal of time with the computer and develop a strong talent. It supports a lot of the math material we teach, i.e., related programs [but] it takes time away from studying the textbook. My classes are always further behind than classes that don't bother with it.

[But] More teachers have become interested. Slowly, more will use it." Obviously, the key to diffusion of computer technology for instruction is the classroom teacher. In those instances where the teacher is motivated, computer applications are well accepted. As one principal reports: "We have had a faculty so enthusiastic that at coffee time when the shop talk used to be football or salary schedules, you now find mostly computer talk; i.e., 'what's wrong with my program' or 'I did this today on the computer.' Next year when we offer a computer class to our students, I can see strong support from our faculty since most are applying it to their specific classes." Evidently with skill and confidence in the use of computers, teachers of other subjects will begin to use the computer to augment, enrich, and aid their own course offerings.

Management of Instruction

One way that educators have effectively used computers has been as a tool for the management of the instruction. Principals report that the computer has relieved teachers from clerical work and allowed them more time for planning and teaching; it has helped teachers "standardize" teacher-made tests, and it has aided the management of students through individualized programs of study. In this latter use, the computers permit the teachers to individualize the instruction by identifying student deficiencies and by planning curriculum accordingly. In this way students are given more freedom and a chance to do something on their own such as earning a license to operate the computer. In addition, the computer makes possible the frequent rescheduling of teachers and students in flexible modular scheduling programs and permits a closer analysis of student achievement by the teacher at each instructional phase. In addition, the computer has been effectively used for grading and in the development of more readable and accurate report cards.

New Curriculum

One significant and recurring observation reported by principals is that the computer in the classroom has stimulated the development of more creative and higher levels of instruction. With the computer, teachers

are able to present concepts (particularly in math and science) in greater depth while students are able to solve more complex problems. The computer has prompted interdisciplinary programs in math, science, and business; it has permitted teachers to concentrate on scientific principles rather than computation; it allows students to solve theoretical problems using interactive methods; and, has prompted in math departments a shift of emphasis to such topics as numerical methods, approximations, matrix theory, base number systems and theoretical applications through simulations.

According to these principals, the potential of instructional computing is just beginning to be understood by secondary educators and as one principal succinctly said, "They [computers] are opening up new fields of study that are quite vast--so vast that it's hard to tell where to start."

Accessibility

Though the computer has shown to be a worthy addition to an instructional program, especially in math and science, the greatest problem currently facing educators is fully utilizing the computer to which they currently have access. Because of its demonstrated impact on improving instruction, and its ability to stimulate student learning, computer terminals and computer time are in high demand. Obviously, simply introducing a computer capability into a school is not enough. Once operational, and after staff and students have used the system, more than one or two terminals are needed to meet the needs of a majority of students attending user schools.

Most of the survey respondents indicate that their major problems with instructional computing are caused by limited personnel time and the lack of terminals.

Usually schools report that the one or two terminals available in their school are used most frequently on a one-to-one student basis. Given the constraints of fully loaded student schedules, few study hall periods, and a generally high level of student demand, an individual's access to a terminal is restricted. Despite attempts to operate the system for longer hours (one school reports their computer system operates from 7:30 a.m. to 9:30 p.m. every school day), bringing the terminal to the

classroom rather than bringing the student to the terminal, and having more than one student access a terminal at one time, the current situation prevents meeting the learning needs of the majority of students by denying them accessibility, by retarding the growth of teacher-developed programs, and by short-circuiting attempts to introduce the computer to other teachers.

Underlying the problem of accessibility is the lack of money. For computer applications not only to survive in secondary education but also, and more importantly, to thrive, more school resources are needed to support computer-based education. Current computer users need substantially more financial support than that currently received to sustain and to expand their efforts beyond math problem solving or science simulations. Secondly, for instructional computing to grow, additional instructional personnel are required to not only monitor the use of the computer but also to develop the system's full capability. Few schools, it appears, recognize that teachers involved with computer application should be provided the necessary release or compensatory time to incorporate the computer into their instructional program or to train other teachers in its use. In support of this argument, the Project CASE survey indicates that 87.9 percent of responding user schools (N=373 schools) do not provide teachers release time for computer application while only 12.1 percent do provide "comp" time to the staff for their computer-based instructional efforts. Of those schools providing release time for computer applications activity, the median amount of release time is three days per month.

Though local support is available for a school to access a computer system, current funds are not sufficient to fully support the instructional demands created by computer-based education. Judging from the results of the survey, school administrators who do support the introduction of the computer into the school's program fail to understand that once the investment is made, the school's program cannot go on "business as usual." What is ignored is that unlike many instructional innovations (movie projectors, overheads, etc.) that simply satisfy an instructional need, the computer not only meets a previously defined learning need but also because of its tremendous information storage and retrieval capability, stimulates the creation of a new level of demand, both on the part of students and teachers knowledgeable in computer technology.

Instructional Materials

Beside the problem of time and money, principals recognize the need for better and more resource materials for computer-based instruction. Though the priority of computer-based learning material has been recognized as an obstacle to the growth of instructional computing (Hunter, Kastner, et al, 1975), respondents to the Project CASE survey view the problem of instructional software and supplementary course materials as a secondary problem to the terminal dilemma. In general, when this problem was cited by a respondent, the comment usually referred to the lack of appropriate text material for their courses rather than software/courseware considerations. A common complaint was that texts were either too difficult (too large in scope), too easy (too small in scope), or simply not in existence. In several cases, however, explicit reference was made to the fact that not enough curriculum was currently available to choose from and that too little support from local, state, or the federal government was available to write quality computer-based curriculum material. Obviously, the impact of the problem has been limited because of administrative bottlenecks that limit student accessibility to computer-based instruction.

Other Problems

Other problems that concerned educators were the recurrent problems of hardware and occasionally software malfunction, teacher reluctance to participate, and the problem of accessing computers (primarily for batch processing) not located at or near the school. In particular, the slow turnaround time (24-48 hours or more) between job submission and job return has proven to be demotivating and frustrating to students developing initial programming skills.

In summary, as indicated by the evaluative comments submitted by respondents, instructional computing is working effectively within the instructional programs of many schools, but is having somewhat limited impact on the total school curriculum. Though each year more and more schools are introducing computers to the curriculum, a large number of students are still not utilizing this device to aid or guide their learning. As one school principal observed, the problem of student access

became so critical that his school discontinued their use of a large, central computer system in favor of equipping each student carrel in the math classroom with programmable desk top calculators. In this way each student gained programming experience and had available the calculating power when he or she needed it, without the delay and frustration of waiting for the terminal.

One could conclude that if funding does not become available to support the use of computers within a school's educational program, other instructional alternatives, such as the desk top calculators that are equally promising but less frustrating and more cost effective, may be education's solution to the instructional problem.

SUMMARY AND CONCLUSIONS

Major Findings

The study provides both a quantitative and qualitative review of the extent and nature of computer use in secondary schools. With a primary focus on instructional computing, the study shows the growth of secondary school computer applications since the previous study in 1970 and explores the current state and future of instructional computing at the secondary school level.

Specific key findings are:

- Since 1970 computing in secondary education has steadily increased with 58.2 percent of the schools who responded to Project CASE survey indicating they are currently using a computer for administrative and/or instructional purposes (34.4 percent in 1970).
- The trend is toward more fully using the computer. Of schools using computers, only those using them for both administrative and instructional uses increased from 1970 to 1975 (26.2 percent to 37.5 percent). The percentage of schools using computers for administrative or instructional purposes dropped from 1970 to 1975 (62.5 percent to 54.1 percent for administration; 11.3 percent to 8.4 percent for instructional).
- Given the findings concerning the growth of secondary school computing for the last five years (1970-1975), and with the assumption that the current rate of adoption of computer technology in the schools (4.8 percent/year) will continue, it can be projected that within the next decade every secondary school in the country will have access to a computer system for some type of administrative and/or instructional application.
- Respondents indicated that using the computer as a "Problem Solving Tool" and as a subject area for "Computer Science" courses were the most frequently utilized instructional applications in secondary education.
- In schools using computers CAI has increased from 8.4 percent in 1970 to 13.8 percent in 1975.
- The predominant instructional use of computers in 1975 is still for Mathematics.
- With regard to administration the most frequent uses of the computer are for Student Accounting and Resource Management.

- The BASIC language has become the predominant computer language for instructional computing.

- Schools who used computers tended to be larger than non-user schools (median number of students 1000 versus 400). The size of the user schools, however, is smaller than 1970 when the median number of students was 1347.

- The current survey indicates that over 90 percent of the funding for educational computing at the secondary school level comes from local and state sources.

- Despite the growth in computing activities there was virtually no change since 1970 in the relative amount of the operating budget spent for instructional computing ($0.18 per $100 of school expenditures in 1975 versus $0.17 in 1970).

Computers in Education

Though the use of computers has not as yet been universally introduced in every school, the adoption of computer technology in secondary education has been both steady and stable with more and more schools accessing computers each year while fewer schools are terminating a previously established computer application. Thus, despite generally rising costs for school operation and tight budgets, individual schools and school systems are committing locally generated educational dollars to computerize their information management systems and to enhance the quality of their instructional programs.

Though the continued growth of computer-based education seems assured, the specific future of instructional computing is unclear. Based upon the growth over the last five years (1970-1975), it is projected that within the next decade the majority of secondary schools in the country will have some type of instructional computer-based application. While earlier consensus studies of computer-based instruction (Luskin, 1970; Doyle and Goodwill, 1971) predicted through Delphi techniques that the majority of secondary schools would have CAI by 1985, the Project CASE data indicates that by 1985 no single computer-based instructional application (e.g., CAI, or Problem Solving, or CMI, etc.) is likely to be found in the majority of secondary schools. Instead, it is expected that the current trend toward diversified instructional computing will continue. Although the survey indicates an increase in the number of schools using CAI and Gaming and Simulation it is highly probable that Computer Science and

Problem Solving will remain prominent instructional applications through the next decade. Without a dramatic technological breakthrough in the capability and costs of computer hardware (to include terminals), availability of software, and without a significant change in the independent nature of secondary schools, it is expected that over the next ten years secondary education will continue to use the computer-based instructional application that best meets an individual school's instructional needs.

Related to this issue is a school's motivation for initiating a computer application. Over the last five years the computer has to a greater degree been introduced into the curriculum to not only enhance the instructional experience of more able students, but also as an effective instructional tool to meet the learning needs of students with both average and lower abilities or with disadvantaged backgrounds. There has been an increase of "computer literacy" courses in which schools have initiated an introductory computer course so that all students can become familiar with the advantages and limitations of computer technology. Other examples include CAI math and reading for less able or disadvantaged students, computer programming classes for nonacademic students, and the introduction of programmable desk top mini computers into math departments for use by all students studying mathematics at various levels. It can be expected that this trend will continue and that more secondary school students will experience computer technology in one form or another as an integral part of their secondary school experience.

Problems Ahead

Despite the general good prospects for computer-based education, the future of instructional computing is intimately related to the resolution of many problems that face those secondary educators who wish to initiate or expand their instructional computing activities. Many of these barriers have been described by other researchers (Anastasio and Morgan, 1972; Carnegie Commission, 1972; Zinn, 1970). In general, the problems involve system costs, the exchange of information, utilization of available resources, and individual and institutional receptivity to innovation. Based upon the Project CASE survey experience, it can be said that few solutions to these problems appear on the immediate horizon.

A major problem tied to future growth is fund availability. Despite the reality that specific instructional computer systems, especially mini-systems are becoming available at low cost, the initiation and expansion of instructional computing is being jeopardized by inadequate funds. Though the survival and expansion of instructional computing has been made possible primarily by local funding, the investment of local school systems in instructional computing tends to be quite modest. As a result, expansion of computer applications into the other disciplines beyond Math and Science has been hampered. Funds for additional hardware, increased language capabilities, more terminals, software development, and greater faculty involvement have been limited by the economics of local school district budgeting. Obviously, if instructional computing is to survive and, more importantly, thrive within a school or school system, additional funding will be needed. As education's investment in its own computing future increases, the market potential of instructional computing at the secondary level will substantially increase, bringing with it renewed support from private enterprise, federal, and state government.

The second problem facing secondary education is the relatively isolated nature of instructional computing at the secondary level. Though the Project CASE survey shows that many schools today have some type of formal cooperative arrangement with other computer-interested organizations, the majority of schools are operating within an information vacuum. Despite the volume of professional publications, user groups newsletters, and professional meetings that serve as major mechanisms for information dissemination, many schools or school systems are still "reinventing the wheel" with their development of uniquely tailored software or software systems. Though previous calls have been made for a centralized national clearinghouse for instructional users, most recently by Seidel and his colleagues (Hunter, et al, 1975), there appears to be little in the way of an enduring and concentrated effort in that direction. Though it can be said that the learning experience of "reinventing the wheel" may be quite valuable for a school, nonetheless it is a costly adventure in terms of time, dollars, and personnel. It is precisely for these reasons--cost, efficiency, and effectiveness--that one would expect that a sharing of resources, expertise, program libraries, and information through an active clearinghouse would enhance the productive movement of educational computing.

The third problem concerns the rather narrow base of educational computing activities. Over the last five years instructional computing has survived and grown primarily due to the personal investment of a handful of individuals located in schools and colleges throughout the country. As it was in 1970, instructional computing within a school is still the responsibility of one or two individuals who have committed their own time, talent, and energy to the introduction of the computer into their school's educational program. Although valuable assistance has been provided by consortiums of computer users (Project Delta, OTIS, Dartmouth School Project, TIES, etc.), the individual teacher or administrator is still the mainstay of instructional computing at the secondary school level. Despite the advances made to date, the expansion of instructional computing in the future will depend upon the involvement of a larger number of individuals both inside and outside the school system. Some indication that such support is available is evidenced by such innovative developments as the "Peoples Computer Company" which is a storefront computer center offering computer literacy courses for school age children and adults. Other organizations that are creatively introducing computers to children are the Hennepin County Library (Minneapolis-St. Paul), The Science Museum of Minnesota, the Science Museum Association of Roanoke Valley (Roanoke, Virginia), and the Oregon Museum of Science and Industry. These institutions are offering computer experiences (computer literacy courses, programming, teletype activities for exhibit evaluation, etc.) for library and museum patrons (including school age children as well as other visitors). Through such efforts of concerned librarians and museum administrators, the complex world of computer technology has become an understandable reality to many hundreds of students and adults served by these organizations. Consistent with Ivan Illich's (1970) Deschooling of Society and Silber's (1972) Learning System, both of which view the entire community as a learning resource, these innovative efforts are indicative of the many new partners in education available to the public school system. Though at present these community-based computer resources are limited, their potential benefit for instructional computing is great. Just as schools utilize the advantages of computer consortiums today, secondary education in the future may find it profitable to establish more cooperative links with other community-based institutions to share

resources, expertise, and computer facilities to help meet the learning needs of their students. The Project CASE survey data indicates that secondary schools currently access computer capability from a variety of resource organizations, including both public and private institutions. With today's technologically sophisticated terminals and communications media, a school's access to one or more computer systems is limited only by its resourcefulness in identifying and utilizing existing community-based computer systems. Through such cooperative interaction with other community institutions, secondary education will be able to provide students with an ever increasing variety of educational experiences.

The fourth and final problem confronting secondary education computing involves individual and institutional acceptance of computer technology as an instructional medium. As evidenced by its history, the adoption of any innovation in education is an arduous process involving many years of effort which frequently results in little, if any, impact on the operation of the educational system. It has been stated that introducing a new innovation to education is frequently like adding a new piece of chrome to an old and outdated automobile. It makes the auto look new but it certainly does not improve its performance. Even the introduction of a relatively straightforward and nonthreatening innovative teaching strategy takes several years. Hall and Rutherford (1975) report that the adoption behavior of teachers to "faculty teaming" can take from three to five years. They submit that this time interval permits the teachers to move from being concerned with how the innovation affects or interferes with their own lives to the point of fully considering how the innovation helps their students. In general, the process of diffusing innovation within education has few hard and fast rules (Widman, 1975).

When dealing with an issue as volatile as computer technology the problems of educational innovation become even more complex. Concerns of individual teachers, administrators, entire institutions, or the community that the computer will take over the school should be addressed in a straight-forward fashion. The benefits and limitations of computer-based education should be fully and realistically discussed. It should be made clear that despite the computer's vast information storage and retrieval capability, the student will not become the servant of the machine.

Educators responding to the Project CASE survey report that the use of the computer tends to broaden the educational program and not limit it. Moreover, these educators indicate that the introduction of computers into the educational process does not stifle creativity and promote conformity but instead stimulates teachers and students to seek new and more effective ways of making the computer work for them.

If we are to fully realize the potential of computers in education, more effort must go into the dissemination of information about computers to administrators, teachers, students, and parents. It is not enough for those involved in computer applications to exchange information among themselves. They must be prepared to help others discover what they have learned from experience--that computers can make education a richer, more individual, and more human process.

REFERENCES

Anastasio, E., & Morgan, J. Factors inhibiting the use of computers in instruction. Princeton, N.J.: EDUCOM, Interuniversity Communications Council, 1972.

Carnegie Commission on Higher Education. The fourth revolution: Instructional technology in higher education--a report and recommendations. New York: McGraw-Hill, 1972.

Darby, C. A., Korotkin, A. L., & Romashko, T. Survey of computing activities in secondary schools. Washington: American Institutes for Research, R70-13, 1970.

Datapro Research Corporation. Directory of suppliers. Delran, N.J.: Author, 1974.

Doyle, F., & Goodwill, D. An exploration of the future in educational technology. Bell Canada, January 1971. (Cited by Hunter et al., 1975).

Hall, G., & Rutherford, W. Concerns of teachers about implementing faculty teaming. Paper presented at the annual meeting of the American Educational Research Association, Washington, 1975.

Hunter, B., Kastner, C., Rubin, M., & Seidel, R. Learning alternatives in U.S. education: Where student and computer meet. Englewood Cliffs, N.J.: Educational Technology, 1975.

Illich, I. Deschooling society. New York: Harper & Row, 1970.

Luskin, B. An identification and examination of obstacles to the development of computer-assisted instruction. Unpublished doctoral dissertation, University of California, 1970.

Nie, N., Bent, D., & Hull, C. Statistical package for the social science. New York: McGraw-Hill, 1970.

Silber, K. The learning system. Audiovisual Instruction, 1972, 17, 10-30.

Widman, J. What makes innovation work in Massachusetts? Strategies for state and local systems. Paper presented at the annual meeting of the American Educational Research Association, Washington, 1975.

Zinn, K. An evaluative review of uses in computers in instruction. Ann Arbor: University of Michigan, 1970.

APPENDIX A

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A SURVEY OF COMPUTING ACTIVITIES IN SECONDARY SCHOOLS

This survey is being conducted by the American Institutes for Research under a grant from the Education Directorate, National Science Foundation. Our objective is to obtain accurate information about the nature and extent of computer usage in American secondary schools today. We feel this can best be accomplished bv securing information directly from the schools.

Please respond to the survey whether or not your school uses computers.

GENERAL INSTRUCTIONS

The focus of this survey is on administrative and instructional applications of computers in secondary education. To accurately determine the nature and extent of computer usage, your response is urgently needed **WHETHER OR NOT YOUR SCHOOL USES COMPUTERS.**

The survey is divided into five sections:

Section A – General information about your school
Section B – Checklist of specific computer applications
Section C – Computer budget
Section D – Computer hardware
Section E – Instructional applications

Please use the following procedures when completing the questionnaire:

- **If your school does not use a computer (see definitions below), complete only Section A**
- **If your school uses a computer for administrative purposes, complete Sections A, B, C, and D**
- **If your school has one or more instructional applications, complete all five sections (A-E).**

Please answer all questions. When a question is not applicable or when information is not available, check (✓) N/A.

Although the survey has been sent to the school principal, it may be advisable to assign each section of the questionnaire to the staff member most knowledgeable in that area of the program. One person could then coordinate the completion of the questionnaire and be responsible for its return.

DEFINITIONS

In order that all respondents may have the same frame of reference in answering the questionnaire, "computer usage" is defined for the purpose of this survey.

What is a computer?

For this study, a computer is defined as a machine that operates under the control of a stored program. The term "computer" includes the central processing unit, auxiliary storage, communication links, and all peripheral equipment.

The programmable desk top calculator is to be included, but only when it is operated with a stored program. Electronic accounting machines are specifically excluded from this definition.

Access to the Computer

To be included in this study, the computer may be accessed in any or all of the following ways:

- **computer physically present in the school**
- **terminal in school, connecting with computer at any location (e.g., a network of schools on a time-shared system)**
- **computer facilities located near the school**
- **computer services provided by the school system (e.g., scheduling, payroll, etc.)**

For further information, please contact:

Dr. William Bukoski, Jr.
American Institutes for Research
3301 New Mexico Avenue, N.W.
Washington, D.C. 20016
Telephone: 202/686-6800 or 686-6859

Section A. GENERAL INFORMATION

A-1 **Name of individual to be contacted concerning this questionnaire:**

_____

A-2 **School telephone number** _____ _____
area code

A-3 **School name** _____

If the address shown on the mailer is incomplete or incorrect, please provide correct information below:

_____
street

_____
city state zip code

A-4 **What grade levels are included in your school?**

Grades _____ through _____

A-5 **Type of school**

- ☐ Academic
- ☐ Comprehensive
- ☐ Vocational
- ☐ Other (specify) _____

A-6 **Current type of instructional program**

- ☐ Classes are scheduled for group instruction
- ☐ The instructional program is individualized
- ☐ Other (describe briefly) _____

_____

_____

_____

A-7 **Current Enrollment**

- ☐ under 100
- ☐ 100–299
- ☐ 300–499
- ☐ 500–799
- ☐ 800–999
- ☐ 1000–1499
- ☐ 1500 + (specify) _____

A-8 **Number of full time teachers in your school** _____

A-9 **If applicable, what percentage of last year's graduating class continued their education?**

College _____%

Technical School _____%

Community College _____%

N/A ☐

A-10 **Does your school currently have access to a computer for either administrative or instructional purposes?**

- ☐ Yes
- ☐ No

A-11 **If YES, what specific application(s) is made of the computer?**

- ☐ Administration only (student accounting, payroll, planning, etc.)
- ☐ Instruction only (EDP courses, CAI, CMI, etc.)
- ☐ Both administration and instruction
- ☐ N/A

A-12 **If your school previously used a computer but has stopped, please indicate the reason:**

- ☐ Insufficient funds
- ☐ Ineffective computer system (specify) _____

_____

- ☐ Experimental project ended
- ☐ Lack of qualified staff
- ☐ Other (specify) _____

_____

- ☐ N/A

A-13 **How was the computer previously used?**

- ☐ Administration only
- ☐ Instruction only
- ☐ Both administration and instruction
- ☐ N/A

A-14 **Does your school intend to initiate one or more new computer applications within the next year?**

- ☐ Yes
- ☐ No

A-15 **If YES, how will the computer be used?**

- ☐ Administration only
- ☐ Instruction only
- ☐ Both instruction and administration
- ☐ N/A

A-16 **Indicate the anticipated funding source for the new application(s)**

- ☐ U.S. Office of Education
- ☐ National Science Foundation
- ☐ Other federal agency (specify) _____
- ☐ State
- ☐ Local
- ☐ N/A
- ☐ Private foundation (specify) _____

_____

- ☐ Other (specify) _____

_____

If your school currently uses computers, please go on to Section B on the following page. ▶

If your school does not currently use a computer, you have provided all the necessary information. Please fold and staple the questionnaire as directed and mail it to us. Thank you for your help.

Section B. COMPUTER USES

This section describes specific instructional and administrative applications of computers in secondary schools. Please indicate (✓) the type of computer application(s) currently included in your school program.

INSTRUCTIONAL APPLICATIONS

B-1 **Computer assisted instruction** (including drill and practice, tutorial and dialogue modes using programmed instruction) ☐

B-2 **Computer used as a computational aid** (for problem solving in subjects such as mathematics, science, economics, etc.) ☐

B-3 **Teaching computer science or data processing skills** (including the preparation of input, machine operation, programming and systems analysis skills) ☐

B-4 **Gaming and simulation** of real-life situations ☐

B-5 **Computer managed instruction** (including diagnosis of student learning needs and prescription of individual instruction) ☐

B-6 **Guidance and counseling** (including academic guidance, occupational counseling). Test scoring and analysis by a commercial test publisher should not be reported as a computer application. ☐

B-7 **Any other instructional application** (please specify) ☐

_____

_____

ADMINISTRATIVE APPLICATIONS

B-8 **Student accounting** (including student schedules, student records, attendance, grades, report cards, etc.) ☐

B-9 **Research and evaluation** of teaching methods, curriculum materials, etc. ☐

B-10 **Resource management and planning** (including maintaining personnel and financial records, projection of enrollments, transportation, scheduling, etc.) ☐

B-11 **Any other administrative application** (please specify) ☐

_____

_____

Section C. BUDGET

Please provide the following information about your school's budget and source of funding for computer applications. If this information is not available, check (✓) N/A.

C-1 **Your school's total annual operating budget**

Amount $ _____ ☐ N/A

C-2 **Your school's annual budget for computer applications**

a. Administrative applications $ _____ ☐ N/A

b. Instructional applications $ _____ ☐ N/A

C-3 **Percent of annual computer budget by source of funding and by application**

	Administrative applications N/A ☐	Instructional applications N/A ☐
Local	_____ %	_____ %
State	_____ %	_____ %
National Science Foundation	_____ %	_____ %
Title I	_____ %	_____ %
Title III	_____ %	_____ %
Other Federal (specify)		
_____	_____ %	_____ %
_____	_____ %	_____ %
Private Foundations (specify)		
_____	_____ %	_____ %
_____	_____ %	_____ %
Other (specify)		
_____	_____ %	_____ %
_____	_____ %	_____ %
TOTAL	100%	100 %

Section D. COMPUTER HARDWARE

List below the manufacturer, model number and storage capacity for each computer your school uses.		List below the manufacturer, model number, and number of terminal(s) used, if any, with each computer		Indicate (✓) present application for each computer.			Indicate (✓) the arrangement for use by your school for each computer.				Indicate (✓) what organization provides the computer. Specify organization name.					
Manufacturer/Model of computer(s)	Storage capacity (in characters)	Manufacturer/Model of terminal(s)	Number of Terminals	Administration	Instruction	Both	Own	Lease	Time Purchased	Time Donated	School or school system	College/university	Regional computer consortium	Commercial firm	Other	Name of organization
1.		a.														
		b.														
		c.														
2.		a.														
		b.														
		c.														
3.		a.														
		b.														
		c.														

If your school uses the computer for any INSTRUCTIONAL purpose, please go to Section E.

If you have no instructional applications in your school, you have provided all the information needed for the survey. Please fold and staple the questionnaire as directed and mail it to us. Thank you for your help.

Section E. INSTRUCTIONAL APPLICATIONS

This section of the survey deals with each of your school's Instructional Applications of the computer. As a reminder, each application is defined in Section B, page 4 of this survey.

On the chart on the next page, please describe how the computer has been incorporated into your school's instructional program. Please check (✓) N/A if your school does not have a particular application.

For each computer application currently used by your school, please indicate the following:

A. **Specific subject area(s)** of instruction (algebra, geometry, chemistry, etc.). For a guidance and counseling application, describe the specific use of the computer (e.g., to develop student profiles from diagnostic tests, etc.).

B. **Grade level** for each subject area.

C. **Number of classes** in that subject area using the computer out of the total number of classes in that subject area and grade (e.g., 1 tenth grade geometry class out of 3 use the computer = 1/3).

D. **Total number of students** currently participating in the course using the computer.

E. **Total number of teachers** directly involved in the course using the computer (i.e., writing programs, lecturing, running programs, etc.).

F. **The length of the course.** If the course has a fixed length indicate the number of weeks the course is in session and place an "F" for fixed length beside the number. If the course is individualized, indicate the average amount of time needed by students to master the material. Place an "I" for individual instruction after this number.

G. **The average number of hours of connect time per month** used by students and teachers working in the course.

H. **The average number of batch jobs run per month** by students and teachers working in the course.

I. **The programming language for the application.**

E-1. INSTRUCTIONAL APPLICATIONS

Please complete Sections A-I of the chart according to the instructions on the previous page. Remember to check (✓) N/A if your school does not have a specific application (i.e., CAI, CMI, etc.).

	A Subject area(s)*	B Grade level	C No. of computer classes/total classes (1/3)	D Number of students	E Number of teachers	F Class length	G Average hours connect time per month	H Average number of batch jobs per month	I Indicate (✓) programming language: Fortran	Basic	Cobol	PL/1	Coursewriter	Other (specify)
Computer assisted instruction N/A ☐														
Computational aid in problem solving N/A ☐														
Teaching computer science or data processing N/A ☐														
Gaming and simulation N/A ☐														
Computer managed instruction N/A ☐														
Guidance and counseling N/A ☐														
Other (specify)														

*If additional space is needed, please xerox the form, complete, and attach to this questionnaire.

E-2. COOPERATIVE SUPPORT OF COMPUTER APPLICATIONS

For each computer application, briefly describe the type of cooperative support (non-financial) available from other sources. Support could include sharing of computer facilities, staff, information, program libraries, etc.

Computer Applications	Sources of cooperative support (specify type of support)			
	Computer network with other schools	Educational institution	Manufacturer	Other (specify) _____
Computer assisted instruction N/A ☐				
Computational aid in problem solving N/A ☐				
Teaching computer science or data processing N/A ☐				
Gaming and simulation N/A ☐				
Computer managed instruction N/A ☐				
Guidance and counseling N/A ☐				
Other (specify) N/A ☐				

E-3 **Are the teachers participating in instructional computer applications provided release time for their computer related activities (i.e., release from ordinary teaching duties)?**

☐ YES Average amount of release time per teacher per month:

Number of days _____

☐ NO

E-4 **How many members of your staff (including teachers, counselors, and administrative personnel) have had formal training in the use of computers?**

Number of staff _____

E-5 **Indicate (✓) the type of organization(s) that conducted and/or sponsored this training:**

Source of Training	(✓) Type of Support	
	Conducted training	Sponsored training
National Science Foundation		
College or university		
U.S. Office of Education		
Technical or computer school		
Computer manufacturer		
Other (specify)		

N/A ☐

E-6 Who prepares software (programs, system documentation, etc.) for your school's computer application(s)? Check (✓) all appropriate boxes.

- ☐ Teachers in your school
- ☐ Teachers from other schools in your school system
- ☐ Commercial computer firms

(specify) _____

_____

- ☐ Students
- ☐ Other school systems
- ☐ Colleges and universities
- ☐ Publishing companies (specify)

_____

- ☐ Other (specify) _____

_____

E-7 Have your school's instructional computer applications been evaluated?

☐ YES ☐ NO

☐ Evaluation in progress

E-8 If YES, briefly describe the main findings of the evaluation.

E-9 Briefly describe any problems encountered by your school in using computers for instructional purposes.

E-10 How has the use of the computer affected your instructional program?

Thanks for taking your valuable time to complete this questionnaire.

Now here comes the easy part – just fold, staple, and mail to us.

Thanks again!

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AMERICAN INSTITUTES FOR RESEARCH
WASHINGTON OFFICES
3301 New Mexico Avenue, N.W., Washington, D. C. 20016
Telephone: (202) 686-6800

October 7, 1974

Dear Principal:

The expanding use of computers in secondary education is a subject of interest for federal, state and local educational agencies. What is required is current and factual information concerning computer usage in secondary schools to guide planning and policy decisions so that appropriate programs can be established that reflect the nations educational priorities.

In response to this need, the American Institutes for Research under a grant from the National Science Foundation is conducting a nationwide survey to learn more about the nature and extent of computer usage in American secondary schools. From the more than 23,000 secondary schools recorded in the School Universe File developed by the National Center for Educational Statistics, over 5,000 schools have been selected by scientific random procedures for this study. As one of these schools, the American Institutes for Research invites you to participate by completing the enclosed questionnaire.

Since the major purpose of this study is to determine the extent of computer use on a national level, it is essential that each school respond regardless of that school's current use of the computer. PLEASE COMPLETE THE QUESTIONNAIRE EVEN THOUGH YOUR SCHOOL MAY NOT CURRENTLY USE A COMPUTER. NON-USERS NEED ONLY COMPLETE SECTION A OF THE QUESTIONNAIRE. To determine the current level of computer use, all data will be aggregated for analysis and reporting purposes and no comparisons between schools will be made. With your cooperation the data generated by the survey will be complete and valid and will provide a sound basis for projecting at the national level the extent and scope of computer use in the secondary schools.

Though the survey requests information that is generally available from various members of your staff, there may be instances when the Office of Superintendent of Schools could be of assistance. For this reason, your Superintendent has been notified of the survey and invited to participate in the study and provide any assistance you may need to complete the questionnaire.

Thank you for your help in assembling this much needed information. A report of the survey findings will be made available to you upon request.

Sincerely yours,

ARTHUR L. KOROTKIN, Ph.D.
Principal Investigator
Communications Research Group

ALK:cg
Encl.

AIR
AMERICAN INSTITUTES FOR RESEARCH / 3301 New Mexico Avenue, N.W., Washington, D.C. 20016 Telephone: 202/686-6800

PROJECT CASE
Computing Activities
in Secondary Education

Arthur L. Korotkin, Ph.D.
Principal Investigator,
American Institutes
for Research

William J. Bukoski, Ph.D.
Project Director, American
Institutes for Research

Advisory Board

William F. Atchison, Ph.D.
Senior Computer Scientist,
National Institute of
Education

Truman Botts, Ph.D.
Executive Director,
Conference Board of the
Mathematical Sciences

Thomas A. Dwyer, Ph.D.
Professor of Computer
Science, University of
Pittsburgh

Glenn R. Ingram, Ph.D.
Acting Assistant Director
for Productivity and
Technology, National
Institute of Education

James W. Jacobs, Ed.D.
Associate Superintendent
for Planning Management
and Computer Services,
Montgomery County, Md.
Schools

EVEN IF YOU DO NOT USE COMPUTERS, PLEASE READ THIS LETTER

November 25, 1974

Dear Principal:

As part of a research project sponsored by the National Science Foundation, we recently sent you, as a member of our sample of secondary school principals, a questionnaire concerning computer applications in your school. If you have already returned that questionnaire, thank you for your participation.

If you have not yet returned the questionnaire, we would like to ask you to please take the time to provide us with the information requested. Our experience indicates that some principals thought that we wanted returns only from computer users. On the contrary, we need returns from non-users as well as users, in order to measure the true level of computer activities in American schools. If your school does not use a computer in any way, less than five minutes is required to provide the general information about your school requested in Section A of the questionnaire. If your school is currently using computers for either administrative or instructional purposes and you have not yet participated in our study, we hope that you will take this opportunity to respond to our survey. A questionnaire is enclosed for your convenience.

Needless to say, both the project staff and our Advisory Board view this research as extremely important and would appreciate your participation in the study.

Thank you for your assistance.

Sincerely,

Arthur L. Korotkin

Arthur L. Korotkin, Ph.D.
Principal Investigator
Communications Research Group

Appendix A-4

A SURVEY OF COMPUTING ACTIVITIES IN SECONDARY EDUCATION

Introduction:

Recently, under a grant from the National Science Foundation, the American Institutes for Research sent to a select sample of secondary school principals, a questionnaire concerning the use of computers in their school for either administrative and/or instructional purposes. If you have returned that survey, thank you for your assistance. If you have not had the opportunity to respond, please answer the three questions below. Then, upon completion, fold along the dotted line, staple and mail to us (Be sure AIR's address is facing outward).

Thank you for your contribution to our research effort.

1. Does your school currently use a computer for either administrative or instructional purposes?

For example: Administrative uses would include payroll or other budgetary data computed and provided to your school by the school system; student scheduling; resource management, etc. Instructional uses would include: computer assisted instruction; using the computer for problem solving; teaching data processing; guidance and counseling (except for commercial test scoring); etc.

- ◯ Yes, for administrative uses only
- ◯ Yes, for instructional uses only
- ◯ Yes, for both administrative and instructional uses
- ◯ No, our school does not use a computer

2. What is the source of funding for your school's computer use?

- ◯ Local
- ◯ State
- ◯ Other (specify) _____
- ◯ U.S. Office of Education
- ◯ National Science Foundation
- ◯ Not Applicable

3. Does your school intend to initiate one or more computer applications (new or additional) within the next school year?

- ◯ Yes, for administrative uses only
- ◯ Yes, for instructional uses only
- ◯ Yes, for both administrative and instructional uses
- ◯ No,

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AIR
AMERICAN INSTITUTES FOR RESEARCH /3301 New Mexico Avenue, N.W., Washington, D.C. 20016

OCTOBER 22, 1974

DEAR SUPERINTENDENT:

THE EXPANDING USE OF COMPUTERS IN SECONDARY EDUCATION IS A SUBJECT OF INTEREST FOR FEDERAL, STATE AND LOCAL EDUCATIONAL AGENCIES. WHAT IS REQUIRED IS CURRENT AND FACTUAL INFORMATION CONCERNING COMPUTER USAGE IN SECONDARY SCHOOLS TO GUIDE PLANNING AND POLICY DECISIONS SO THAT APPROPRIATE PROGRAMS CAN BE ESTABLISHED THAT REFLECT THE NATION'S EDUCATIONAL PRIORITIES.

IN RESPONSE TO THIS NEED, THE AMERICAN INSTITUTES FOR RESEARCH UNDER A GRANT FROM THE NATIONAL SCIENCE FOUNDATION IS CONDUCTING A NATIONWIDE SURVEY TO LEARN MORE ABOUT THE NATURE AND EXTENT OF COMPUTER USAGE IN U.S. SECONDARY SCHOOLS. OVER 5000 SECONDARY SCHOOLS HAVE BEEN IDENTIFIED BY RANDOM SAMPLING PROCEDURES AND MAILED A QUESTIONNAIRE. THIS SAMPLE INCLUDES THE FOLLOWING SCHOOLS FROM YOUR SCHOOL DISTRICT:

BENJAMIN FRANKLIN HIGH SCHOOL
MARTIN LUTHER KING HIGH SCHOOL
MC DONALD VOCATIONAL SCHOOL

SINCE THE SURVEY WILL YIELD VALUABLE INFORMATION NEEDED BY EDUCATIONAL PLANNERS AND DECISION MAKERS AT ALL LEVELS, WE ARE REQUESTING YOUR COOPERATION AND SUPPORT OF OUR EFFORTS. WITH YOUR ASSISTANCE THE DATA GENERATED BY THIS STUDY WILL BE COMPLETE AND WILL ACCURATELY DESCRIBE THE EXTENT OF COMPUTER USE BY THE NATION'S SECONDARY SCHOOLS. A COPY OF THE SURVEY IS ENCLOSED FOR YOUR INFORMATION.

THANK YOU FOR YOUR HELP IN THIS MOST IMPORTANT STUDY. A REPORT OF THE SURVEY FINDINGS WILL BE MADE AVAILABLE TO YOU UPON REQUEST.

SINCERELY YOURS,

ARTHUR L. KOROTKIN, PH.D.
PRINCIPAL INVESTIGATOR
COMMUNICATIONS RESEARCH GROUP

ALK:CG

AIR

AMERICAN INSTITUTES FOR RESEARCH / 3301 New Mexico Avenue, N.W., Washington, D.C. 20016 Telephone: 202/686-6800

March 31, 1975

PROJECT CASE
Computing Activities in Secondary Education

Arthur L. Korotkin, Ph.D.
Principal Investigator, American Institutes for Research

William J. Bukoski, Ph.D.
Project Director, American Institutes for Research

Advisory Board

William F. Atchison, Ph.D.
Senior Computer Scientist, National Institute of Education

Truman Botts, Ph.D.
Executive Director, Conference Board of the Mathematical Sciences

Thomas A. Dwyer, Ph.D.
Professor of Computer Science, University of Pittsburgh

Glenn R. Ingram, Ph.D.
Acting Assistant Director for Productivity and Technology, National Institute of Education

James W. Jacobs, Ed.D.
Associate Superintendent for Planning Management and Computer Services, Montgomery County, Md. Schools

Dear Sir:

As part of a national survey of secondary schools concerning their use of computers for administration or instruction, AIR under a grant from the National Science Foundation invited several schools from your school system to participate in our study. A letter describing the survey and listing the specific school(s) from your school system in our sample, as well as a review copy of the survey instrument, was sent to your office.

Though the school response has been good, the returns to our survey are not complete. Enclosed is a condensed one-page questionnaire to be completed for each school from your system that according to our records has not yet responded to our study. The name of the school is printed on a mailing label affixed to the questionnaire(s). Since a high response rate is essential to our investigation, we would appreciate your support and assistance in providing this information.

Would you please take a few moments of your valuable time to provide us with this very important information. Both the project staff and our Advisory Board view this research as extremely important and would appreciate your participation in the study.

Sincerely,

Arthur L. Korotkin, Ph.D.
Principal Investigator
Communications Research Group

ALK/egs

Encl.

Appendix A-7

A SURVEY OF COMPUTING ACTIVITIES IN SECONDARY EDUCATION

School: [SCHOOL MAILING LABEL INSERTED]

1. Does this school currently use a computer for either administrative or instructional purposes?

   For example: Administrative uses would include payroll or other budgetary data computed and provided to the school by the school system; student scheduling; resource management, etc. Instructional uses would include: computer assisted instruction; using the computer for problem solving; teaching data processing; guidance and counseling (except for commercial-test scoring); etc.

   ☐ Yes, for administrative uses only

   ☐ Yes, for instructional uses only

   ☐ Yes, for both administrative and instructional uses

   ☐ No, the school does not use a computer

2. What is the source of funding for the school's computer use?

   ☐ Local

   ☐ State

   ☐ U.S. Office of Education

   ☐ National Science Foundation

   ☐ Other (specify)_____

   ☐ Not Applicable

3. Will the school initiate one or more new or additional computer applications with the next school year?

   ☐ Yes, for administrative uses only

   ☐ Yes, for instructional uses only

   ☐ Yes, for both administrative and instructional uses

   ☐ No, the school will not be expanding its use of the computer with the next school year

   ☐ Not Applicable

Please enclose the completed questionnaire in the self-addressed envelope provided for your convenience.

Thank you for your contribution to our research effort.

APPENDIX B

		Page
B-1	Manufacturer's Letter and Survey	B-1
B-2	Examples of Computer Systems Currently Employed in Secondary Education	B-10
B-3	Manufacturer's Comments on the Problems and Future of Computer-Based Education at the Secondary School Level	B-30

AIR
AMERICAN INSTITUTES FOR RESEARCH / 3301 New Mexico Avenue, N.W., Washington, D.C. 20016 Telephone: 202/686-6800

PROJECT CASE
Computing Activities
in Secondary Education

Arthur L. Korotkin, Ph.D.
Principal Investigator,
American Institutes
for Research

William J. Bukoski, Ph.D.
Project Director, American
Institutes for Research

Advisory Board

William F. Atchison, Ph.D.
Senior Computer Scientist,
National Institute of
Education

Truman Botts, Ph.D.
Executive Director,
Conference Board of the
Mathematical Sciences

Thomas A. Dwyer, Ph.D.
Professor of Computer
Science, University of
Pittsburgh

Glenn R. Ingram, Ph.D.
Acting Assistant Director
for Productivity and
Technology, National
Institute of Education

James W. Jacobs, Ed.D.
Associate Superintendent
for Planning Management
and Computer Services,
Montgomery County, Md.
Schools

January 6, 1975

Dear Sir:

The American Institutes for Research under a grant from the National Science Foundation is conducting a survey of the uses of computer systems by American secondary schools for administrative and instructional purposes. The research includes a national survey of secondary schools (schools with grades 9, 10, 11, or 12) and a survey of all computer hardware manufacturers. The school survey will provide data about the extent and type of computer use in the schools while the manufacturer's survey is designed to provide information about the types of computer systems used by the schools for administrative and instructional purposes.

To assist us in our study, we would appreciate the completion of the enclosed Computer Manufacturer's Survey. **PLEASE RESPOND TO THE SURVEY WHETHER OR NOT YOUR FIRM HAS EDUCATIONAL CUSTOMERS.** The information provided by this survey will be reported as submitted and will serve as a guide for schools interested in exploring administrative and instructional uses of computers. A copy of the final report on this project will be available upon request.

Thank you for your cooperation and assistance in gathering this vital information.

Sincerely,

Arthur L. Korotkin, Ph.D.
Principal Investigator
Communications Research Group

COMPUTER ACTIVITIES IN SECONDARY SCHOOLS

A SURVEY OF COMPUTER MANUFACTURERS

INTRODUCTION

This study is being conducted by the American Institutes for Research under a grant from the Education Directorate of the National Science Foundation. The survey has three sections:

SECTION A: General information about your firm.

SECTION B: An overview of computer systems manufactured by your firm and used in secondary education for administrative and/or instructional purposes.

SECTION C: Your views on the future of computer based education at the secondary school level.

With your cooperation the current nature of computer based education at the secondary level can be described and its future direction assessed.

Thank you in advance for your participation in this study. For further information, please contact:

William J. Bukoski, Ph.D.
Project Director
Project CASE/Computer Activities in Secondary Education
American Institutes for Research
3301 New Mexico Avenue, N.W.
Washington, D.C. 20016
Telephone: 202/686-6859

SECTION A.

GENERAL INFORMATION

1. Name of firm _____

2. Name of individual completing the Survey: _____

   Division _____

   Title _____

   Address _____
   (street)

   _____
   (city) (zip code)

3. Briefly describe the type of computer products or services marketed by your firm and used in secondary education. If your firm currently does not have secondary school customers, briefly describe your firm's plans for entering this marketing area in the near future in terms of the products or services that you will be providing.

   Please check (✓) if your firm is not now and is not planning to enter the secondary education marketing area: ☐ NOT APPLICABLE

If your firm currently has secondary school customers, please complete the remaining sections of the questionnaire. ▶

If your firm currently does not serve secondary schools, you have completed all the necessary information. Please fold and staple the questionnaire as directed on the back and mail it to us.

Thank you for your assistance.

SECTION B

COMPUTER SYSTEMS CURRENTLY USED FOR SECONDARY EDUCATION

1. Briefly describe how three specific secondary schools are currently using your firm's computing system(s) for administrative and/or instructional purposes. Because we recognize that your firm may manufacture a variety of computing systems with various configurations, we request that you select three school programs that best illustrate how your firm's computing systems are meeting the educational needs of secondary school customers. Toward this end we request that you describe each school's current configuration in terms of:

   A. The specific administrative and/or instructional function of the system. For example, administrative functions would include payroll, bus schedules, personnel records, etc.; while instructional functions would involve computer assisted instruction, teaching computer science, using the computer for problem solving,simulations, etc.

   B. The school's (school system's) hardware configuration to include the name and model of the computer(s); storage components (on-line and off-line); on-line storage capacity in appropriate units; the type and number of terminals; and peripherals.

   C. The programming languages used with the system (FORTRAN, COBOL, BASIC, etc.); and the software and/or courseware operating on the system (FORTRAN-student scheduling, BASIC-CAI reading, grades 1-9 etc.)

   D. The cost of the hardware in terms of purchase or lease prices (on a monthly basis); maintenance costs; and the cost of the software and/or courseware operating on the system in terms of purchase or lease prices.

PLEASE PLACE YOUR THREE DESCRIPTIONS ON THE FOLLOWING THREE PAGES.

SECONDARY SCHOOL COMPUTER SYSTEM No. 1

Name of School/School System _____

Address _____
(street)

_____
(city) (zip code)

Estimated Number of Students _____

PART A. Specific Administrative/Instructional Functions

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic-CAI Geometry Grades 9-11)

PART D. Computer and Software/Courseware Costs

		1	2	3
COMPUTER	Computer(s) Name/Model No.	_____	_____	_____
	Purchase price (if applicable)	$ _____	$ _____	$ _____
	Lease price (if applicable)	$ _____ /month	$ _____ /month	$ _____ /month
	Maintenance cost	$ _____ /month	$ _____ /month	$ _____ /month
SOFTWARE/ COURSEWARE	Program or course Name		Purchase price (if applicable)	Lease price per month (if applicable)

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

SECONDARY SCHOOL COMPUTER SYSTEM No. 2

Name of School/School System _____

Address _____
(street)

_____
(city) (zip code)

Estimated Number of Students _____

PART A. Specific Administrative/Instructional Functions

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic CAI Geometry Grades 9-11)

PART D. Computer and Software/Courseware Costs

		1	2	3
COMPUTER	Computer(s) Name/Model No.	_____	_____	_____
	Purchase price (if applicable)	$ _____	$ _____	$ _____
	Lease price (if applicable)	$ _____ /month	$ _____ /month	$ _____ /month
	Maintenance cost	$ _____ /month	$ _____ /month	$ _____ /month

SOFTWARE/COURSEWARE	Program or Course Name	Purchase Price (if applicable)	Lease Price per month (if applicable)

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

SECONDARY SCHOOL COMPUTER SYSTEM No. 3

Name of School/School System _____

Address _____
(street)

_____
(city) (zip code)

Estimated Number of Students _____

PART A. Specific Administrative/Instructional Functions

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic CAI Geometry Grades 9-11)

PART D. Computer and Software/Courseware Costs

		1	2	3
COMPUTER	Computer(s) Name/Model No.	_____	_____	_____
	Purchase Price (if applicable)	$_____	$_____	$_____
	Lease Price (if applicable)	$_____/month	$_____/month	$_____/month
	Maintenance Cost	$_____/month	$_____/month	$_____/month

SOFTWARE/COURSEWARE	Program or Course Name	Purchase Price (if applicable)	Lease Price (if applicable)

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

SECTION C.

THE FUTURE OF COMPUTER BASED EDUCATION AT THE SECONDARY SCHOOL LEVEL

1. Briefly describe the major problems encountered by the computing industry in assisting secondary schools to use computers for their educational program and indicate how these problems may be alleviated.

2. What do you feel is the major thrust today of computer based education at the secondary school level and what trends in the computer industry appear relevant for the future use of computers in secondary education?

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COMPUTER SYSTEMS CURRENTLY USED IN SECONDARY EDUCATION

BURROUGHS CORPORATION

1. Name of School/School System Minnesota School Districts Data Processing Joint Board (TIES)

   Address 1925 West Country Road B-2
   (street)

   St. Paul, Minnesota 55113
   (city) (zip code)

   Estimated Number of Students 300,000

PART A. Specific Administrative/Instructional Functions

- Census Information System
- Finance/Budget
- Student Information System including Scheduling, Mark Reporting, Attendance, Transportation and CMI and CAM
- Payroll/Personnel

PART B Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

Burroughs B4700
500KB main memory
500MB disk storage

unit record peripherals
Burroughs display and printing terminals

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic-CAI Geometry Grades 9-11)

COBOL - Administrative Applications

PART D. Computer and Software/Courseware Costs

		1	2	3
COMPUTER	Computer(s) Name/Model No.	Estimated B4700		
	Purchase price (if applicable)	$ 500,000	$	$
	Lease price (if applicable)	$ 14,000 /month	$ /month	$ /month
	Maintenance cost	$ 2,000 /month	$ /month	$ /month
SOFTWARE/ COURSEWARE	Program or course Name		Purchase price (if applicable)	Lease price per month (if applicable)

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

2. Name of School/School System Livonia School District

Address 15125 Farmington Road
(street)

Livonia, Michigan 48154
(city) (zip code)

Estimated Number of Students 38,000

PART A. Specific Administrative/Instructional Functions

- Financial including General Ledger, Purchasing, Warehouse Inventory, Accounts Payable and Bed Processing and online update/inquiry
- Test Scoring
- Student Records
- Scheduling including online update/inquiry master schedule guide
- Cafeteria Accounting . Library . Audio/Visual . Cooperative Education
- Test Site for Burroughs SCHOLASTIC School Administrative Systems

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

- B3500
- 110KB main memory
- 100MB disk memory
- unit record peripherals
- Burroughs TD terminals

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic CAI Geometry Grades 9-11)

COBOL

PART D. Computer and Software/Courseware Costs

		1	2	3
COMPUTER	Computer(s) Name/Model No.	Estimated B3500		
	Purchase price (if applicable)	$ 300,000	$	$
	Lease price (if applicable)	$ 8,000 /month	$ /month	$ /month
	Maintenance cost	$ 1,500 /month	$ /month	$ /month

SOFTWARE/COURSEWARE	Program or Course Name	Purchase Price (if applicable)	Lease Price per month (if applicable)
	SCHOLASTIC Scheduler	5,000	varies depending on computer model
	" Financial	3,600	
	" Student Records	2,700	
	" Payroll	3,240	
	" Test Scorer	3,400	

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

3. Name of School/School System Penta County Vocational High School

Address 30335 Oregon Road
(street)

Perrysburg, Ohio 43551
(city) (zip code)

Estimated Number of Students 2,000

PART A. Specific Administrative/Instructional Functions

Administrative
- Attendance Accounting and Control
- Capital Goods Inventory

Instructional
- Data Processing Training in Operations and Programming

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

- B1714
- 32KB main memory
- 4.6MB disk storage
- unit record peripherals

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic CAI Geometry Grades 9-11)

RPG
COBOL

PART D. Computer and Software/Courseware Costs

		1 Estimated	2	3
COMPUTER	Computer(s) Name/Model No.	B1714		
	Purchase Price (if applicable)	$ 75,000	$	$
	Lease Price (if applicable)	$ 1,300 /month	$ /month	$ /month
	Maintenance Cost	$ 300 /month	$ /month	$ /month

SOFTWARE/COURSEWARE	Program or Course Name	Purchase Price (if applicable)	Lease Price (if applicable)

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

DIGITAL EQUIPMENT CORPORATION

1. Name of School/School System Wachusett Regional High School

Address 1401 Main Street

Holden,Massachusetts 01620

Estimated Number of Students 2,000

PART A. Specific Administrative/Instructional Functions:

Administrative Functions:

Scheduling
Attendance Reporting
Grade Reporting
Student Data Base

Instructional Functions:

Teaching Computer Science, Math, Social Studies
Business Subjects and Science Subjects
Problem Solving
Simulations
Some Tutorial modes
CAI and CMI

PART B. Hardware Configuration (Computers, Storage Components, On-Line Capability, Type and Number of Terminals, Peripherals).

Type of Computer

DIGITAL PDP-11/40, with 40K word core memory, working under RSTS/E (Resource Sharing Time Sharing System - Extended)

Number of Terminals

1 - LA30
5 - ASR 33 Teletype
2 - Other Terminals

Peripherals

1 - DIGITAL Card Reader - The optical mark reader reads marked or punched tab cards at a rate of 300 cards per minute. No special pen or pencil is needed to mark the Standard 12-row, 40 column Optical Mark Card.

2 - DIGITAL RK-05 Moving Head Cartridge Disks. The RK-05 Control and removable cartridge disk provide a convenient way to store a large quantity of data (1.2 to 1.6 million words) in a high-speed, randomly accessible format.

1 - DIGITAL High-Speed Paper Tape Reader and Punch. The paper tape reader photo-electrically reads 8-channel, fanfold, perforated tape at 300 characters per second, which prints 200 lines per minute.

PART C. Programming Languages - Software/Courseware (e.g. Fortran-Class Scheduling; Basic CAI Geometry Grade 9-11)

BASIC-PLUS Programming Language	95%
Macro	5%

All software for scheduling, Grade Reporting and Attendance Reporting was developed by local personnel on site.

PART D. Computer and Software/Courseware Costs

Computer

Computer(s) Name/Model No.	PDP 11/40	
Purchase Price (if applicable)	$ 74,142	
*Lease price (if applicable)	$ N/A	/month
Maintenance cost	$ 775.00	/month

* 3 yr. lease purchase

2. Name of School/ School System Project Delta

Address DSAA University of Delaware

Newark, Delaware 19711

Estimated Number of Students 4,000

PART A. Specific Administrative/Instructional Functions

Project Delta is a student-oriented computer center and research effort. The goals of this project are to expose all Delaware students from grades 7-12 to computers.

Project Delta is sponsored by the University of Delaware; 22 Delaware High Schools are affiliated with the project. Only instructional functions are performed including problem solving, simulations, and writing programs in math, social science, chemistry, biology and physics classes. The current thrust is in math and social science and when these areas are fully satisfied, Project Delta will concentrate on other disciplines such as language, history, theatre and communications.

PART B. Hardware Configuration (Computers, Storage Components, On-Line Capability, Type and Number of Terminals, Peripherals).

1 - PDP 11/50 with 64 K word core memory
1 - PDP 11/20 with 28 K word core memory
2 - Digital RP-03 high performance moving-head disk unit, with data storage capacity of 24 million and a 2.9 millisecond average seek time.
1 - Industry compatible magnetic tape, for storage of large masses of data in a serial manner, or for interchange of files between computer systems.
1 - High speed paper tape reader and punch. Electrically reads 8-channel, fan fold, perforated tape at 300 characters per second.
1 - Optical mark card reader, reads marked or punched tab cards at a rate of 300 cards per minute. No special pen or pencil is needed to mark the standard 12-row, 40 column mark sense card.
2 - RS-11 Fixed-head disks, provide fast random access swapping and bulk storage; one disk stores 262,144 words of data.
22 - ASR 33 Teletype Terminals, operate at 10 characters per second, and have built in paper tape reader and punch for saving and reusing programs from individual terminals.
1 - LP-11 Line Printer, prints 300 lines per minute.

PART C. Programming Languages

Basic-Plus which runs under Digital's RSTS/E (Resource Sharing Time Sharing System/Extended.)

PART D. Computer and Software/Courseware Costs

Computer	1	2
Computer(s) Name/Model No.	PDP-11/50	PDP-11/20
Purchase price (if applicable)	$260,000 approx.	85,000 approx.
Lease Price (if applicable)	N/A /month	N/A /month
Maintenance cost	$20,000/year	9,300 /year

3. Name of School/School System - Idaho Falls School System

Address 690 John Adams Parkway School District #91

Idaho Falls, Idaho 83401

Estimated Number of Students 1,000

PART A. Specific Administrative/Instructional Functions:

Administrative Functions:

Idaho Falls School System has implemented a payroll system which performs calculations for salaried and hourly employees as well as for employees who earn a fixed amount per day. The system produces paychecks, payroll summary reports, deduction registers and year-end forms such as W-2's.

Other administrative systems are: complete Accounts Payable package, revenue and expenditure reporting, student grade reporting, attendance reporting, student fee reporting, and scheduling. Programs are written in Basic-Plus and operate under RSTS-11 (Resource Sharing Time Sharing) an operating system designed for multiple interactive programs.

Specific Instructional Functions:

The computer is being used as a tool to motivate students' interest in the curriculum areas of math and science. Students are also learning to program in the Basic-Plus language, and are writing programs for problem solving and simulation applications in a wide variety of curriculum areas.

Elementary and Jr. High students are using the computer for drill and practice in mathematics and reading.

PART B. Hardware Configuration (Computers, Storage Components, On-Line Capability, Type and Number of Terminals, Peripherals).

Digital Equipment Corporation's PDP-11/20 configured with 28 K word main memory operating under RSTS-11 operating system.

4 RK-05 Moving Head Cartridge Disks each with storage capacity of 1.2 million words in a randomly accessible format.

Dual DEC-Tape which may be randomly referenced at any point in the reel and may be read or written in either direction. Each reel holds 370,000 characters of information.

8 Terminals Include

5 - ASR 33 Teletype
1 - DEC writer which prints quietly at a speed of 30 characters per second.
2 - Other Terminals. 6 of the terminals are remote and 2 are local.
1 - Card Reader
1 - LP-05 Line Printer which prints 200 lines per minute.

PART C. Programming Languages

All programs for both administrative and instructional functions are written in the Basic-Plus Language.

Idaho Falls School System has designed a series of programs called Elementary Instructional Programs, which are supplemental instructional material for the elementary school and Jr. High School's reading and math curricula. The programs provide drills in addition, subtraction and multiplication, as well as spelling and phonics. An outstanding advantage of these drills is that students find out immediately (before they go on to the next problem) how well they performed and are given congratulatory messages for correct answers and helpful hints for solutions to incorrect answers.

Programs are also provided for drill and practice in fractions; addition, subtraction, multiplication and division with common and different denominators, and concepts of greatest common factors, reducing fractions, improper fractions, inverses and reciprocals. Correct responses receive positive reinforcement while incorrect answers cause helpful hints to be given.

Although the programs do not maintain records of students performance for later teacher analysis, the programs do type out the students score based upon - number of problems tried, number correct and percentage correct at the end of each program session.

PART D. Computer and Software/Courseware Costs

Computer

Computer(s) Name/Model No.	PDP - 11/20 28K word memory
Purchase Price (if applicable)	$ 85,000 approx.
Lease Price (if applicable)	$ N/A /month
Maintenance cost	$ 9,300 /year

HEWLETT-PACKARD COMPANY

1. Name of School/School System Los Angeles City Schools

Address 450 North Grand Avenue
(street)

Los Angeles, CA 90012
(city) (zip code)

Estimated Number of Students 6,200

PART A. Specific Administrative/Instructional Functions

1. CAI - HP Math, Reading, Language Arts
2. Problem Solving
3. Simulations
4. Test Scoring
5. Test Generation
6. Computer Science
7. Grade Reporting
8. Attendance

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

7 - 2000C Hi Speed with 5M byte disc, 32 port capability
2 - 2000F with 5M byte disc, 32 port capability
200 Teletype terminals
100 CRT Terminals
1 LPR
1 Card reader

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic-CAI Geometry Grades 9-11)

BASIC - CAI
IDF - CAI
BASIC - Problem solving, simulations
Math D&P

PART D. Computer and Software/Courseware Costs

		1	2	3
COMPUTER	Computer(s) Name/Model No.	2000C	2000F	
	Purchase price (if applicable)	2000F now sold ~~instead~~	$ 70K	$
	* Lease price (if applicable)	$ /month	$ 1900 /month	$ /month
	Maintenance cost	$ 600 /month	$ 600 /month	$ /month
		Program or course Name	Purchase price (if applicable)	Lease price per month (if applicable)
SOFTWARE/ COURSEWARE		Math Reading Language Arts		$1/~~mo~~ yr. $320/mo

NOTE: if additional space is needed, please supply the requested information on a separate page and attach.

2. Name of School/School System Nashoba Valley Technical School

Address Littleton Road
(street)

Westford, MA 01886
(city) (zip code)

Estimated Number of Students 1000

PART A. Specific Administrative/Instructional Functions

1. Problem Solving using BASIC
2. Simulations
3. CAI
4. CAI in 4 Mass. State Penal Institutions
5. Records management for traveling education vans
6. Student Scheduling
7. Grade Reporting
8. Payroll
9. Accounting

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

2000C - 32 port capability
23-1/2 M bytes of disc
1 magnet tape drive
1/2 M fixed head disc
1 card reader
50 terminals in various schools, government and penal institutions
1 printer

PART C. Programming Languages -- Software/Courseware (e.g., Fortran-Class Scheduling; Basic CAI Geometry Grades 9-11)

BASIC - accounting
BASIC - payroll
FORTRAN - class scheduling
BASIC - simulations
BASIC - problem solving
BASIC - CAI
BASIC - grade reporting-attendance
IDF - CAI

PART D. Computer and Software/Courseware Costs

		1	2	3
COMPUTER	Computer(s) Name/Model No.	2000C-Hi Speed		
	Purchase price (if applicable)	$ 2000F sold now instead	$	$
	Lease price (if applicable)	$ /month	$ /month	$ /month
	Maintenance cost	$ 750 /month	$ /month	$ /month

SOFTWARE/COURSEWARE	Program or Course Name	Purchase Price (if applicable)	Lease Price per month (if applicable)
	CAI Courseware		
	Reading		
	Language Arts		$320/mo
	G.E.D.		

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

3. Name of School/School System Wayne Public Schools

Address 50 Nellis Drive
(street)

Wayne, NJ 07470
(city) (zip code)

Estimated Number of Students 12,000

PART A. Specific Administrative/Instructional Functions

CAI- Math
Problem Solving
Simulations
Test Scoring
Computer Science
Grade Reporting
Attendance Accounting
Payroll
Budget and Accounting
College Selection

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

1 - 3000, 1 mag tape, 47 Mbyte Disc, 16 port capability line printer card reader
3 - 2000C' 5 M byte disc - 32 ports
2 - 2000F 5 M byte disc - 32 ports
105 terminals

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic CAI Geometry Grades 9-11)

Basic - Problem Solving
Basic - Simulations
IDF - CAI
Basic - College Selection
Fortran - Accounting
Cobol - Grade Reporting
Cobol - Attendance
Cobol - Scheduling

PART D. Computer and Software/Courseware Costs

COMPUTER

	1	2	3
Computer(s) Name/Model No.	1 - 3000-100	3 - 2000C	2 - 2000F
Purchase Price (if applicable)	$ 185,000	2000F sold now $ instead	$ 70,200 per system
*Lease Price (if applicable)	$ 6,000 /month	$ _____ /month	$ 1,900 /month
Maintenance Cost	$ 1,000 /month	$ _____ /month	$ 600 /month

SOFTWARE/COURSEWARE

Program or Course Name	Purchase Price (if applicable)	Lease Price (if applicable)
Math Drill and Practice		$1 one time charge
SIS(Student Info. System		$7500 one time charge
SAS (Student Scheduler)		$7500 one time charge
IDF (author language)		$1 one time charge
IMF (CAI management facility)		$1 one time charge

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

CONTROL DATA CORPORATION

1. Name of School/School System Region IV Education Service Center

Address 2000 West Loop
(street)

Houston, Texas
(city) (zip code)

Estimated Number of Students _____

PART A. Specific Administrative/Instructional Functions

	No. of Students		No. of Students
{1} Student Scheduling	150,000	{8} Computer Science	150,000
{2} Grade Reporting	150,000	{9} Problem Solving	150,000
{3} Attendance Accounting	250,000		
{4} Test Scoring	400,000		
{5} Payroll	25,000		
{6} Financial Accounting	14 Districts		
{7} Tax Support Accounting	10 Districts		

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

Control Data 6600
Remote Job Entry Terminals .. 13 ..
Interactive Terminals 175

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic-CAI Geometry Grades 9-11)

FORTRAN - Student Instruction/Math, Science
BASIC - Student Instruction/Math, Science
COBOL - Student Instruction/Business

PART D. Computer and Software/Courseware Costs

	1	2	3
COMPUTER: Computer(s) Name/Model No.	CDC 6600		
Purchase price (if applicable)	$ 3,500,000	$	$
Lease price (if applicable)	$ _____ /month	$ _____ /month	$ _____ /month
Maintenance cost	$ 12,000 /month	$ _____ /month	$ _____ /month

SOFTWARE/COURSEWARE: Program or course Name	Purchase price (if applicable)	Lease price per month (if applicable)

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

2. Name of School/School System Springfield High School, Springfield, Illinois

Address University High School, Urbana, Illinois
(street)

(city) (zip code)

Estimated Number of Students _____

PART A. Specific Administrative/Instructional Functions

PLATO - Computer Based Education for student instruction in various disciplines.

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

PLATO terminals linked to Computer Based Education Research Laboratory (CERL) at the University of Illinois.

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic CAI Geometry Grades 9-11)

TUTOR - Author Language - Remedial reading, mathematics and physical sciences.

PART D. Computer and Software/Courseware Costs

N/A

COMPUTER	1	2	3
Computer(s) Name/Model No.	_____	_____	_____
Purchase price (if applicable)	S _____	S _____	S _____
Lease price (if applicable)	S _____ /month	S _____ /month	S _____ /month
Maintenance cost	S _____ /month	S _____ /month	S _____ /month

SOFTWARE/COURSEWARE	Program or Course Name	Purchase Price (if applicable)	Lease Price per month (if applicable)
	Terminal Cost Purchase	$9,000	
	Computer Use Cost -	$200/month + Communications Line Service Charges	

NOTE: If additional space is needed please supply the requested information on a separate page and attach.

3. Name of School/School System St. Thomas Academy

Address 949 Mendota Heights Road
(street)

Mendota Heights, Minnesota
(city) (zip code)

Estimated Number of Students 500

PART A. Specific Administrative/Instructional Functions

Interactive Time Sharing

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

Control Data Corporation 713 Interactive Terminal - Links to the Control Data Corporation 6400 located at Minnesota Educational Regional Interactive Time-Sharing System.

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic CAI Geometry Grades 9-11)

FORTRAN }
BASIC }
COBOL } - All types of student use
ALGOL }
SNOBOL }

PART D. Computer and Software/Courseware Costs

COMPUTER	1	2	3
Computer(s) Name/Model No.			
Purchase Price (if applicable)	$	$	$
Lease Price (if applicable)	$ /month	$ /month	$ /month
Maintenance Cost	$ /month	$ /month	$ /month

SOFTWARE/ COURSEWARE	Program or Course Name	Purchase Price (if applicable)	Lease Price (if applicable)
	Terminal Cost - Purchased $1,200		
	Service Charge - $300/month		

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

XEROX CORPORATION

1. Name of School/Schcol System Intermediate School District 109

Address (street) Everett

(city) Washington (zip code)

Estimated Number of Students 95,487 students in 27 School Districts

PART A. Specific Administrative/Instructional Functions

Business and Pupil Processing with ISD 109

Developed Software

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

Sigma 9, 80K words, CPI configuration

Edmonds School District has xerox 530 Intelligent Remote Batch Terminal for I/O to Sigma 9

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic-CAI Geometry Grades 9-11)

COBOL, FLAG, MANAGE, METASYMBOL FORTRAN,

CLASS SCHEDULING, BASIC, APL, CPI AND EDMS

PART D. Computer and Software/Courseware Costs

		1	2	3
COMPUTER	Computer(s) Name/Model No.	_____	_____	_____
	Purchase price (if applicable)	$ _____	$ _____	$ _____
	Lease price (if applicable)	$ _____ /month	$ _____ /month	$ _____ /month
	Maintenance cost	$ _____ /month	$ _____ /month	$ _____ /month
SOFTWARE/ COURSEWARE	Program or course Name		Purchase price (if applicable)	Lease price per month (if applicable)

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

2.* Name of School/School System Hampton Public Schools

Address Hampton
(street)

Virginia
(city) (zip code)

Estimated Number of Students 32,000 students in 39 schools

PART A. Specific Administrative/Instructional Functions

Xerox/Aces. For business and pupil processing.
Time sharing for student instruction.
Hampton has a Title III Grant to develop CAI/CMI applications.

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

Sigma 9 Mod 2, 80K words, CPI configuration

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic CAI Geometry Grades 9-11)

Future plans include offering Xerox/Aces services and instructional programs to other local school districts.

PART D. Computer and Software/Courseware Costs

		1	2	3
COMPUTER	Computer(s) Name/Model No.			
	Purchase price (if applicable)	$	$	$
	Lease price (if applicable)	$ /month	$ /month	$ /month
	Maintenance cost	$ /month	$ /month	$ /month

SOFTWARE/ COURSEWARE	Program or Course Name	Purchase Price (if applicable)	Lease Price per month (if applicable)

Xerox only provided two secondary school examples.

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

INTERDATA CORPORATION

1. Name of School/School System North Bergen High School

Address 7317 Kennedy Boulevard
(street)

North Bergen (city) New Jersey 07047 (zip code)

Estimated Number of Students 1500 approx.

PART A. Specific Administrative/Instructional Functions

This system is used to teach computing programming methods in interactive fortran.

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

The hardware configuration consists of an INTERDATA Model 70 with 8000 characters of storage, teletype terminal, and an interactive fortran interpreter.

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic-CAI Geometry Grades 9-11)

Interdata's interactive fortran is utilized at North Bergen High School.

PART D. Computer and Software/Courseware Costs

		1	2	3
COMPUTER	Computer(s) Name/Model No.	Model 70		
	Purchase price (if applicable)	$ 9,000 approx.	$	$
	Lease price (if applicable)	$ NA /month	$ /month	$ /month
	Maintenance cost	$ 150. /month	$ /month	$ /month
		Program or course Name	Purchase price (if applicable)	Lease price per month (if applicable)
SOFTWARE/ COURSEWARE		Interdata's interactive fortran		

B-27 NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

2. Name of School/School System Mainland Regional High School

Address Oak Avenue
(street)

Linwood New Jersey 08221
(city) (zip code)

Estimated Number of Students 1000 approx.

PART A. Specific Administrative/Instructional Functions

This minicomputer system teaches computing programming methods in Basic and Fortran.

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

The hardware in this system is comprised of an Interdata Model 7/16 with 16,000 characters of storage, a card reader and a teletype.

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic CAI Geometry Grades 9-11)

Mainland Regional High School uses Fortran IV and Basic

PART D. Computer and Software/Courseware Costs

		1	2	3
COMPUTER	Computer(s) Name/Model No.	Model 7/16		
	Purchase price (if applicable)	$ 10,125	$	$
	Lease price (if applicable)	$ NA /month	$ /month	$ /month
	Maintenance cost	$ 150 /month	$ /month	$ /month

SOFTWARE/COURSEWARE	Program or Course Name	Purchase Price (if applicable)	Lease Price per month (if applicable)
	Extended Fortran IV		
	Extended Basic		

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

3. Name of School/School System Sparta High School

Address West Mountain Road
(street)

Sparta , New Jersey 07871
(city) (zip code)

Estimated Number of Students 1000 approx

PART A. Specific Administrative/Instructional Functions

This Interdata assemblage performs the function of teaching computer programming methods in interactive Fortran.

PART B. Hardware Configuration (Computers, Storage Components, On-Line Storage Capability, Type and Number of Terminals, Peripherals.)

The hardware arrangement is composed of an Interdata Model 3 with 8000 characters of storage and a teletype.

PART C. Programming Languages – Software/Courseware (e.g., Fortran-Class Scheduling; Basic CAI Geometry Grades 9-11)

Sparta High School utilizes Interdata's interactive Fortran for its programming language.

PART D. Computer and Software/Courseware Costs

		1	2	3
COMPUTER	Computer(s) Name/Model No.	Model 3		
	Purchase Price (if applicable)	$ 11,000 donatio	$	$
	Lease Price (if applicable)	$ NA /month	$ /month	$ /month
	Maintenance Cost	$ 150. /month	$ /month	$ /month

SOFTWARE/ COURSEWARE	Program or Course Name	Purchase Price (if applicable)	Lease Price (if applicable)
	Interdata's interactive Fortran		

NOTE: If additional space is needed, please supply the requested information on a separate page and attach.

COMPUTER MANUFACTURERS' COMMENTS ON THE FUTURE OF COMPUTER-BASED EDUCATION AT THE SECONDARY SCHOOL LEVEL

BRIEFLY DESCRIBE THE MAJOR PROBLEMS ENCOUNTERED BY THE COMPUTING INDUSTRY IN ASSISTING SECONDARY SCHOOLS TO USE COMPUTERS FOR THEIR EDUCATIONAL PROGRAM AND INDICATE HOW THESE PROBLEMS MAY BE ALLEVIATED.

1. The funds are always limited and while the larger schools do an excellent job, the smaller private and state schools do not have the best facilities--they need to have a better method of getting to the sophisticated CPUs and applications. A good example of how to do this is Johnson County Community College in Kansas City.

2. Poor documentation is the major problem encountered by Interdata in assisting secondary schools to use computers for their educational program. This problem can be alleviated by structuring the user manuals in such a fashion so that they are very easy to comprehend.

3. Principal problem from a vendor standpoint is specifying cost justification. Many small districts cannot readily afford the benefits of a general purpose disk-oriented computer. The growing trend toward regionalization and consolidation should alleviate this problem.

4. a. Lack of aggregate funding constrains development of centralized data processing service.

b. Need for leadership and planning at the local, district, regional, and state levels.

5. The largest problems selling to schools exist in the instructional area. This market is not yet very large. Customers often make bad decisions because of lack of computer sophistication. This can be discouraging to the sales force.

Time from initial contact to close of sale is often long. Often education prospects know very little about computers and ask for a machine that can do everything and costs nothing. It can take a year or more of education before they are actually ready to release a real bid. In an effort to be fair, educators generally lead salespeople on even when they have already made up their minds. Sometimes schools will go through the bidding process and vendor selection when they have no funding. Another problem is the educator's propensity to look for handouts.

All of the above tends to increase the time and energy necessary for a sale. This lowers the profits. Low profits means that the company will tend to put its money elsewhere.

I do not know how to solve these problems. Much of our marketing activities are aimed at alleviating this situation.

Educators need to realize that in order to get the product development they need, they will have to offer industry a chance to make comparable profits with other markets. That means to get serious and stop acting like privileged characters. It wouldn't hurt if they kept their students' interests in mind, either. Basically, the priorities of U.S. education are in the wrong place. They'll spend millions of dollars for swimming pools and football stadiums, but not $100,000 for good instructional computing.

6. PROBLEM: Providing a school with a complete business and pupil processing software package plus time-sharing capabilities for instructional processing including such applications tools as problem solving, drill and practice, tutorial, simulation, and curriculum selections, and also providing course author languages to permit educators to easily specify instructional strategies in their CAI and CMI developments at a reasonable price.

SOLUTION: A xerox multi-use system that is capable of running the administrative and classroom education system software plus such user developed course author languages as CAL/APL and P.D.C.P. Such a multi-use system enables the school to provide outside services as a source of revenue and at the same time can provide a social service to the community.

WHAT DO YOU FEEL IS THE MAJOR THRUST TODAY OF COMPUTER-BASED EDUCATION AT THE SECONDARY SCHOOL LEVEL, AND WHAT TRENDS IN THE COMPUTER INDUSTRY APPEAR RELEVANT FOR THE FUTURE USE OF COMPUTERS IN SECONDARY EDUCATION?

1. Major thrust continues to be in the administrative area where costs and benefits are more readily identifiable. Major computer industry trends are a reduction in cost of hardware and dedication by some vendors such as Burroughs to provide preprogrammed administrative systems such as our Scholastic Scheduler, Test Scorer, Payroll, Financial, Student Records, and Instructional Materials. By offering this proven expertise inexpensively on a variety of computer models, the cost and time of achieving administrative benefits will be reduced. In the instructional area, a computer-managed instruction system is capable of accepting any type of curriculum objectives and delivery techniques offer the highest cost/benefit ratio.

2. The major thrust of computer-based education at the secondary school level is definitely in problem solving and computer appreciation.

The tendency for the costs of computers to decrease is the major industry trend which will effect education. When a decent timesharing machine costs less than a teacher, no school will have an excuse not to have one.

3. Computer-aided instruction appears to be the major thrust today of computer-based education at the secondary school level. This service is also known as the Huntington Project and is utilized for such subjects as physics, chemistry, biology, and social studies.

4. The major thrust is in the direction of multi-use...permitting a secondary school to accomplish meaningful business and pupil administrative processing and at the same providing time sharing for student instructional purposes. It is necessary to provide tools which permit educators to easily (without programming experience) develop course material via course author languages. Computer-aided instruction using graphic/displays instead of teletype-like devices are mandatory.

5. a. Distributed computing is viewed as the major thrust today toward Computer-Based Education (CBE). For rapid progress to be achieved in Computer-Based Education, it will be necessary to provide a readily available service from a centralized source. This would alleviate many of the problems associated with cost, breadth of instructional materials, and transportability of lesson material.

b. The mini-processor with BASIC and subject instructional materials will be a strong force in the expansion of CBE.

c. Student access via terminals to a computer resource to learn more about using the computer as an educational tool.

6. [I am] not too sure about the thrust, but the trends must be toward better utilization of the communications media to gain access to systems that they cannot afford. This could lead to consolidation of computers with <u>all</u> secondary schools having access to them.

APPENDIX C

ORGANIZATIONS COOPERATING IN SECONDARY SCHOOL COMPUTING

A List of Organizations Supporting Instructional Secondary School Computing Organized by State and Type of Application

COOPERATING ORGANIZATIONS

NAME OF ORGANIZATION	TYPE OF SERVICE: Computer Service	CAI	Problem Solving	Teaching Computer Science	Gaming and Simulation	CMI	Guidance
ALASKA							
University of Alaska (Fairbanks)	x			x			
ARIZONA							
University of Arizona	x						
Maricopa Community Junior College (Tempearea)	x						
Westinghouse Learning Corp.	x						
ARKANSAS							
Simmons 1st National Bank (Pine Bluff)	x						
CALIFORNIA							
California State University	x		x	x			
Gavilan College (Hollister area)	x	x	x	x	x		
Los Medonos College (Antioch area)	x	x	x	x	x		
San Diego State University		x	x				
University of California at Fresno	x						
University of California at Irvine	x						
University of California at Santa Barbara	x						
University of California at Santa Cruz	x		x	x			
Humboldt County Data Processing Center	x						
Los Angeles Reg. Data Processing Center	x						
Riverside Reg. Data Processing Ed. Center (Sunnymead)	x						
Sacramento Reg. Data Processing Center	x						
Santa Clara Reg. Ed. Center	x						
Louisiana Pacific Corp. (Red Bluff area)	x						
Dow Chemical (Concord area)	x						
Educational Coord. Inc. (Sunnyvale)	x						
G.E. Tymshare	x						
COLORADO							
University of Colorado		x	x	x		x	
Warren Tech-Voc School (Lakewood)	x						
Computer Center (Farmington, N.M.)	x						
Educator's Consultant Service (W. Haven area)	x						
Westinghouse Learning Corp.	x						
CONNECTICUT							
Western Connecticut State College	x		x	x			

COOPERATING ORGANIZATIONS

NAME OF ORGANIZATION	TYPE OF SERVICE: Computer Service	CAI	Problem Solving	Teaching Computer Science	Gaming and Simulation	CMI	Guidance
Warren Tech-Voc School (Lakewood)	x						
Computer Center (Farmington, N.M.)	x						
Educational Consultant Service (W. Haven area)	x						
DELAWARE							
University of Delaware (Project DELTA)	x	x	x	x	x	x	x
General Foods, Inc. (Dover)	x						
FLORIDA							
Florida State University	x						
Florida Jr. College (Jacksonville area)	x						
University of Florida	x	x					
University of N. Florida (Jacksonville area)		x	x	x			
University of S. Florida (Tampa area)				x	x		
GEORGIA							
Computer Spectrum Co. (Douglasville area)	x						
Litton ABS	x						
IDAHO							
Boise State University	x						
Statewide Info System	x						
ILLINOIS							
Aurora College	x		x	x	x		
Eastern Illinois University	x						
Elgin Community College	x						
Illinois Institute of Technology				x			x
Oakton Community College	x						
University of Chicago	x			x			x
University of Illinois		x	x	x			
TIES (Minnesota)			x	x			
Franklin Life Insurance Company (Springfield)	x						
Hinkley Schmidt Water Co. (Argo)	x			x			
McDonnell Douglas Automation Service (St. Louis)	x						
National Computer Network (unspecified)	x						
Westinghouse Learning Corp.	x						

COOPERATING ORGANIZATIONS

NAME OF ORGANIZATION	TYPE OF SERVICE: Computer Service	CAI	Problem Solving	Teaching Computer Science	Gaming and Simulation	CMI	Guidance
Western Union Data Services (Park Ridge)	x						
INDIANA							
Illinois Institute of Technology	x						
Indiana University	x						
Purdue University	x			x			
Tri-State College	x						
State of Indiana	x						
Lake County Data Processing Center	x						
Dana Corp. (Ft. Wayne area)	x						
Indiana Bank and Trust (Fort Wayne)	x						
Lafayette Water Works	x						
McDonald Corp.	x						
Purdue National Bank (Lafayette)	x						
South Indiana Computer Services (Sellersburg area)	x						
Utility Network of America	x						
Westinghouse Learning Corp.	x						
IOWA							
Bowdoin College	x	x	x	x	x		
Luther College	x	x	x	x	x	x	
Indian Hills Community College (Ottamas)	x						
University of Iowa	x					x	
Mid-Iowa Computer Center	x						
N.W. Iowa Computer Center	x	x		x	x	x	
Network Data Processing (Cedar Rapids)	x						
West Bend Elevator (West Bend)	x		x	x	x		
Westinghouse Learning Corp. (Iowa City)	x						
Educational Center (Guswald)	x						
KANSAS							
Barter County Community College	x						
Kansas University	x		x				
Garden National Bank (Garden City)	x						
Cimarron Computer Services (Cimarron)	x						
1st National Bank of Lained	x						
KENTUCKY							
Eastern Kentucky University	x						
Eastern Kentucky Education Development (Ashland)	x						

COOPERATING ORGANIZATIONS

NAME OF ORGANIZATION	TYPE OF SERVICE: Computer Service	CAI	Problem Solving	Teaching Computer Science	Gaming and Simulation	CMI	Guidance
LOUISIANA							
Bossier Computer Services (Ruston area)	x						
Burleigh Knott Computer Service (Arnaudville-Port Barre area)	x						
MAINE							
Bowdoin College (Brunswick)	x	x	x	x	x		
University of Maine	x	x		x			
Instruction Services, Inc. (Durham, N.H.)	x						
Westinghouse Learning Corp.	x						
MARYLAND							
Armco Steel Corp. (Baltimore)	x						
Litton ABS	x						
Martin-Marietta Corp.	x						
MASSACHUSETTS							
Project LOCAL	x	x	x				
ECS	x						
Systems for Educational Time Sharing (SETS) (Waltham)	x						
Nashoba Reg. Technical High School (N. Chilmsford area)	x						
Westinghouse Learning Corp. New York, N.Y.)	x						
MICHIGAN							
Adrian College	x		x		x		
MISD	x	x	x	x	x	x	x
Traverse Bay Area Ed. Information Processing Center	x			x			
Wayne County Data Center	x						
Interstate Data	x						
Kellogg Community College (Jackson)	x						
MINNESOTA							
Bemidji State College	x			x			
Mankato State College	x	x		x	x		x
Moochind College	x			x			
St. John's University	x			x	x		x

COOPERATING ORGANIZATIONS

NAME OF ORGANIZATION	TYPE OF SERVICE: Computer Service	CAI	Problem Solving	Teaching Computer Science	Gaming and Simulation	CMI	Guidance
Southwest State College	x	x	x	x			
University of Minnesota	x	x	x	x	x		
Minnesota Educational Computer Consortium (MECC) (statewide)	x	x	x	x	x	x	x
Total Information for Education Systems (TIES)	x	x	x	x	x	x	x
MERITS	x						
Educational Users Group			x				
S. Minnesota School Library		x	x	x	x		
Mankato Area Voc-Technical School	x						
Moorhead Area Voc School	x						
St. Cloud Area Voc School	x						
MISSOURI							
S.E. Missouri State University	x						
University of Missouri (Rolla and Columbia)	x						
McDonald Douglas Automation Co. (St. Louis)	x						
St. Louis Data Processing Center	x						
MONTANA							
Flathead Valley Community College (Kalispell area)	x						
Montana College of Mineral Science and Technology	x						
Montana State University	x						
Keystone	x						
NEBRASKA							
Education Service Unit	x		x				
1st National Bank and Trust (Lincoln)	x						
NEVADA							
University of Nevada (Reno)	x			x	x		
Eastern Nevada Medical Group	x						
NEW HAMPSHIRE							
Dartmouth College	x	x	x	x	x	x	x
University of New Hampshire Bureau of Educational Testing and Research	x						

COOPERATING ORGANIZATIONS

NAME OF ORGANIZATION	TYPE OF SERVICE: Computer Service	CAI	Problem Solving	Teaching Computer Science	Gaming and Simulation	CMI	Guidance
NEW JERSEY							
Rutgers University	x		x	x	x		
ICS Consortium (Wayne)	x						
Instructional Computer Cooperative (Chatham)	x						
Association of Computer Machines (North New Jersey)	x						
Union Company Technical Institute	x						
MidAtlantic Bank (Clark)	x						
Automated Data Processing, Inc. (Hanover)	x						
Rapidata (Pennsylvania)	x						
Service Bureau Corp. (Allendale area)	x						
S. Jersey Gas Company	x						
Transnet Corp. (Union)	x		x	x			
NEW MEXICO							
University of New Mexico	x						
All Indian Pueblo Council (AIPC)	x						
NEW YORK							
Buffalo State College	x		x	x			
New York State University of Buffalo	x						
State University of New York at Albany	x						
University of Rochester	x		x	x	x		
Board of Cooperative Educational Services (BOCES)	x	x	x	x	x		x
Mid Hudson Regional Computer Center (New Paltz area)	x						
Burroughs Corporation	x						
Finserv Computer Corp. (Peru area)	x						
Mini Computer Systems Inc. (White Plains area)	x						
Monroe Corporation	x						
Bell Aero Systems (Williamsville area)	x						
Westinghouse Learning Corp.	x						
NORTH CAROLINA							
North Carolina State University	x		x				
TUCC	x			x			
Educational Computer Services (Charlotte area)	x						
Research Triangle (Charlotte area)	x						
Litton ABS	x						

COOPERATING ORGANIZATIONS

NAME OF ORGANIZATION	TYPE OF SERVICE: Computer Service	CAI	Problem Solving	Teaching Computer Science	Gaming and Simulation	CMI	Guidance
NORTH DAKOTA							
Dickinson State College	x			x			
University of North Dakota	x						
Educational Cooperative Association	x						
OHIO							
Metro Education Council (Gahanna area)	x						
Metropolitan Dayton Education Cooperative Association (MDECA)	x						
Belmont Tech (St. Clairsville)	x						
Muskingum County Technical School	x						
Chi Corp. (Avon Lake area)	x						
Ed Pro (Toledo)	x						
Litton ABS	x						
Ohio Valley Data Control	x						
Westinghouse Learning Corp. (Iowa City)	x						
Lorain County Education Computer Center	x						
OKLAHOMA							
State Department of Education	x						
Chi Corp.	x						
OREGON							
S.W. Oregon Community College	x						
Oregon Total Information Service (OTIS)							
S.W. Oregon Computer Consortium (SWOCC)				x			
Rock Valley Council on Computer Education	x	x	x	x	x		
PENNSYLVANIA							
Clarion College	x						
Indiana University of Pennsylvania	x						
Lehigh University	x	x	x	x	x		
Pennsylvania State University	x						
Shippenburg State College	x						
Slippery Rock State College	x		x	x			
University of Pennsylvania	x	x					
West Chester State College	x						
Cumberland-Perry Voc Tech School (Clearfield)	x						
Fayette Voc Tech School (Connellsville area)	x						

COOPERATING ORGANIZATIONS

NAME OF ORGANIZATION	TYPE OF SERVICE: Computer Service	CAI	Problem Solving	Teaching Computer Science	Gaming and Simulation	CMI	Guidance
Forbes Rood E Area Voc Tech School (Pittsburgh)	x						
Greater Johnstown Voc Tech School	x						
Lehigh County Voc Tech School	x						
Parkway West Voc School (McDonald)	x						
N. Fayette Voc Tech School	x						
Upper Bucks County Tech School (Perkaskie)	x						
W. Montgomery County Voc Tech School	x						
Computer at State Capitol	x						
Computer Consultants Inc. (New York area)	x						
Community Computer Corp. (Philadelphia)	x						
Mellon Bank (Pittsburgh)	x						
Northeastern Engineering Co. (Clarks Green)	x						
Southwestern Publishing Co. (Wilkes-Barre area)	x			x	x		
Pentamation (Lampeter area)	x						
Westinghouse Learning Corp.	x						
RHODE ISLAND							
Litton ABS	x						
SOUTH CAROLINA							
Rapidata, Inc. (Rapid City)	x						
Western States Wholesale (Pierre)	x						
TENNESSEE							
E. Tennessee State University	x						
Jackson State University	x						
Matthew State Community College	x						
Middle Tennessee State	x			x			
Motlow State Community College	x						x
University of Tennessee	x						
TEXAS							
Cooperative Education Service Center (CESA)	x						
DISD Computer Center (Dallas)	x						
Regional Education Service Centers	x	x	x		x		
University of Houston			x				
Gulf Coast Multi Regional Processing Center	x						

COOPERATING ORGANIZATIONS

NAME OF ORGANIZATION	TYPE OF SERVICE: Computer Service	CAI	Problem Solving	Teaching Computer Science	Gaming and Simulation	CMI	Guidance
UTAH							
State Board of Education	x						
Canyon Lands 21st Century Corp. (Elanding area)	x						
VERMONT							
Suny at Stoneybrook	x				x		
VIRGINIA							
Paul D. Camp Community College (Suffolk area)	x						
Educational Computer Center (Lynchburg)	x						
Richmond Area Math and Science Center	x		x	x			
Norfolk Tech-Voc School	x						
Bert Systems, Inc. (Suffolk area)	x						
WASHINGTON							
Big Bend Community College (Moses Lake)	x						
Centralia Community College (Lacey area)	x						
Evergreen State College	x						
Washington State University	x			x			
Walla Walla College	x		x				
Western Washington State College	x						
Big Bend Computer Consortium	x			x			
Computer Services of Walla Walla	x						
Computer Services, Inc. (Renton)	x						
Computer Systems, Inc. (Tuk Walla)	x						
Uniflite Inc. (Bettingham area)	x						
WISCONSIN							
University of Wisconsin	x	x	x		x	x	
Cooperative Education Service Center	x	x	x		x		
Beloit Computer Center (Waterford area)	x						
Fox Valley Technical Institute (Appleton area)	x						
Dadco Data (North Fond du Lac)	x						
First National Bank of Appleton	x						
First Wisconsin National Bank (N. Fond du Lac)	x						
Figi's, Inc. (Marshfield)	x						

COOPERATING ORGANIZATIONS

NAME OF ORGANIZATION	TYPE OF SERVICE: Computer Service	CAI	Problem Solving	Teaching Computer Science	Gaming and Simulation	CMI	Guidance
Service Bureau Corp. (Milwaukee)	x						
Thilmang Paper Co.	x						
Westinghouse Learning Corp.	x						
Coop Service Agency (Reedsville)	x						
WYOMING							
State Department of Education	x						
Caribou Four Corners, Inc. (Afton area)	x						
GUAM							
Cost Plus Computing (San Jose, Ca.)	x						
MANUFACTURERS							
Data General	x		x				
Digital Equipment Corp.	x	x	x	x	x		x
General Electric Tym-Share Corp.	x			x	x		
Hewlett-Packard	x	x	x	x	x	x	
IBM	x	x	x	x			
Litton Industries	x						
Monroe	x	x	x				
Olivetti	x		x	x			
UNIVAC	x			x			
Wang	x		x	x			
Westinghouse Learning Corp.	x	x				x	
Xerox	x		x	x	x		
National Cash Regiscer	x						

APPENDIX D

EXAMPLES OF INNOVATIVE INSTRUCTIONAL COMPUTING AT THE SECONDARY SCHOOL LEVEL

BOSTON PUBLIC SCHOOLS

Bernard R. Redgate
Assistant to Director
Boston Public Schools
Data Processing Center
205 Townsend Street
Dorchester, Massachusetts 02121

Applications

Computer science, computer programming, and running computer simulations. Will soon be determining direction for the future. Latin School - score and analyze multiple choice tests.

Hardware

IBM 1130, three EDU 20s, and one EDU 25. Used in eight schools in Boston. In November, IBM will install six terminals which will be attached to an IBM 370/145 in Boston City Hall.

Software

Languages - COBOL, FORTRAN, APL.

THE DARTMOUTH SECONDARY SCHOOL PROJECT

John M. Nevison
Kiewit Computation Center
Dartmouth College
Hanover, New Hampshire 03755

Background

In June of 1967 Dartmouth College with the support of NSF began a three-year project exploring the use of computing in secondary schools. Eighteen schools in the New England area participated in the project. The computer was made available for classroom and extra-curricular uses of computing. Program is successful today in the areas of math, science, computer science, social studies, art, languages, and gaming.

Hardware

GE 635 at Dartmouth time shares over 100 terminals.

Software

Languages - FORTRAN, BASIC, ALGOL, and a machine language, DYNAMO, APL, DTSS XPL.

PROJECT LOCAL

Robert N. Haven
Project Director
44 School Street
Westwood, Massachusetts 02090

Background

Project LOCAL (Laboratory Program for CAI Learning) was founded in 1967 and is one of the oldest computer projects for secondary schools in the country. From the original five school members, Lexington, Westwood, Natick, Needham, and Wellesley, the project has grown to serve over 20 schools. The project originally used commercial timesharing services which cost over $100 for each student served. In the 1968-69 school year, costs were reduced to $25 per student, after substituting five small computers for the timesharing service. The computers consisted of three EduSystem 20s and two EduSystem 50s. In subsequent years, the addition of more terminals to each system has driven the per student cost even lower.

Applications

Tool in problem solving, as a vehicle for administering drill and practice sessions, as a calculator in laboratory experiments, and as a medium for demonstrating the operation of math and science concepts. Handles all administrative aspects.

Hardware

3 Edusystem 20s and 2 EduSystem 50s.

Software

Circulates a mini-library of books, research papers, materials, dealing with computers, programs, and instruction. Inservice training courses.

HUNTINGTON COMPUTER PROJECT

L. Braun, Director
College of Engineering
State University of New York at Stony Brook
Stony Brook, New York 11790

Application

The HUNTINGTON TWO's (originally a National Science Foundation project) goal is to develop quality simulation programs to be used to enrich secondary school curricula in physics, biology, and social studies. All HUNTINGTON TWO simulations provide opportunity for learning by student participation and observation.

Simulations make possible projects that could not otherwise be considered due to cost, time limitations, potential danger, the necessity of elaborate equipment, and needed expertise. In a study of disease epidemics, for example, the student defines a population, immunization, and infection percentages, and the recovery rates. The computer than plots the course of the disease and the student can alter the variables to see which has the greatest effect. Other biology simulations are in genetics, pest control, membrane transmission, enzyme reactivity, and photosynthesis.

The computer programs are written in the BASIC language and are restricted in size to allow users of smaller in-house computers to use simulations in their classrooms. Each program is available on paper tape and is accompanied by student, teacher, and resource manuals. The cost of a complete package is $3.00.

The student manual contains the material that might be found in a student workbook: instructions, background, and follow-up questions.

The teacher manual describes how the program is used, what preparation the student will need to use the simulation, questions for discussion, and sample runs of the program to give the teacher an idea how the program runs.

The resource manual is designed to give detailed background on the program's model, and detailed information on the subject of the simulation.

LONG ISLAND REGIONAL INSTRUCTIONAL COMPUTER SERVICE (LIRICS)

Gerry Damm
Director of LIRICS
Instructional Computer Center
Wilson Technical High School
17 Westminster Avenue
Dix Hills, New York 11746

Background

LIRICS is the first regional instructional computer network in New York state, and one of the largest in the United States. The Board of Cooperative Education Services (BOCES) No. 3 in Suffolk County, along with two other district BOCES in Suffolk and Nassau Counties, administer the DEC-system 10 which provides simultaneous time sharing service to over 60 terminals at 40 schools on Long Island.

Software

BASIC, COBOL.

Hardware

DEC 10

Comments

Students graduated from Long Island High School have firm foundation for computer activities in colleges they now attend.

PHILADELPHIA PUBLIC SCHOOLS

Mrs. Sylvia Charp
Assistant Director for Data Processing
21st and Broadway
Philadelphia, Pennsylvania 19103

Applications

Biology and math, computer-based games simulating events, decision strategies and problem solving, computer literacy (junior high school) CAI, SABRE - a system's approach to BASIC reading, VICS - Vocational Guidance Information, computer managed instruction (electronics, consumer education, marketing, and career). Instruction of Management Program (7-8th grades) - evaluation, curriculum, computer management, AIMS - Adoptive Instructional Management in Special Education, staff development.

WAYNE TOWNSHIP PUBLIC SCHOOLS

Henry J. Petersen
Secretary
Instructional Computing Cooperative, Inc.
Wayne Public Schools
122 Indian Road
Wayne, New Jersey 07470

Applications

Was used the first year by the 34 members of the consortium as a math lab experience. Students wrote BASIC language programs for several purposes. Currently has CAI programs in remedial reading, English, and adult areas, drill and practice in math, programs for bookkeeping, science, business, and social studies.

Administrative uses include report cards, scheduling, comprehensive achievement monitoring, accounts payable, budget preparation, grade reporting, attendance, class rank, census records, and a guidance college selection package.

Hardware

Two Hewlett-Packard 2000 owned by Wayne County. Time share access to members plus access to multi-processing HP 3000 and terminal administrative data system.

Software

Languages: BASIC, Instructional Dialogue Facility, CAI Author Facility.

Programs: Text editing package, college selection package, remedial reading, English, Adult (GED), Project materials.

Comments

Teacher training - REACT training materials used.

EASTERN KENTUCKY EDUCATIONAL DEVELOPMENT CORPORATION (EKEDC)

Edwin Jones
Director of EKEDC
925 Winchester Avenue
Ashland, Kentucky 41101

Background

EKEDC was formed in 1965 by 32 school districts in eastern Kentucky with the support of federal funds. Plans call for providing instructional and administrative services to member schools.

Hardware

RCA Spectra 70/45 computer located in Ashland.

Software

Suppes-Jerman CAI drill and practice program in arithmetic. (NA)

Update

No longer offers CAI service to schools. Did have a mathematics and reading program. EKEDC is currently involved in Project ACCESS - grade reporting, student scheduling and teacher's register, computerized planning and budgeting system, and management of school systems.

MEMPHIS CITY SCHOOLS

John F. Merrill, Director
Computer Division
Board of Education, Memphis City Schools
2597 Avery Avenue
Memphis, Tennessee 38112

Applications

Math drill and practice, problem solving, computer science, scheduling, report cards, ranking, standardized test scoring,

attendance, evaluation of various projects through statistical analyses.

Hardware

2 H-P computers, 64 teletype terminals

Software

Guidance and counseling package similar to CUIS.

Comments

Has a community learning lab for culturally deprived children. Different groups of 65 come each day. Use IBM Coursewriter III/360. Children get 2-4 hours computer contact. Other than this program and several at various schools, Memphis has predominantly administrative rather than instructional usage.

HILLSBOROUGH COUNTY PUBLIC SCHOOLS

Mrs. Esther Raker
Data Processing Center
Hillsborough County Public Schools
1407 East Columbus Drive
Tampa, Florida 33605

Applications

Student master file, attendance accounting, mark reporting, test scoring and analysis, pupil records. Personnel/Payroll, vendor, budgetary, and student file. Teletype terminals located in each senior high school, the Learning Center, and the Juvenile Home. These terminals are used to interactively program and execute programs written in the BASIC language. The terminals are used as an integral part of the mathematics and science instructional programs. In addition, certain Computer Math Classes are also taught in the FORTRAN language which is processed in batch mode. Computer system located in the Tampa Bay Vocational-Technical School used in teaching computer science.

Hardware

Telecommunications systems - FASTER-MT and ITF/BASIC

FASTER - series of video terminals and printers located in administrative and instructional offices.
BASIC - teletype terminals located in schools.
IBM 1130 in Tampa Vocational-Technical School.

Software

Program packages from IBM.
Languages: FORTRAN, BASIC, FASTER.

UNIVERSITY HIGH SCHOOL

Robert Davis, Principal
University High School
1210 West Springfield Avenue
Urbana, Illinois 61801

Applications

PLATO CAI in Russian, Latin, French, Biology, etc.; a sequence of courses beginning in grade 7 required of all students entitled "Computer Science and Problem Analysis;" "Heuristics" that uses PLATO, a LOGO "Turtle Lab;" and a multigrade math program, used in grades 4 through 9.

PROJECT PACER

Loyal W. Joos
Oakland Schools
2100 Pontiac Lake Road
Pontiac, Michigan 48054

Background

Has developed and is marketing a computer-based system which provides analytic and prescriptive processing of testing data in a manner which is designed to facilitate the evaluation or assessment of school programs at the classroom level.

PACER utilizes item analysis for curriculum evaluation.

PROJECT TIES

Donald C. Holznagel
Project Manager
Instructional Systems
Project TIES
1925 West County Road B2
St. Paul, Minnesota

Background

Project TIES provides hardware, software, materials, and inservice support to elementary, secondary, and vocational-technical schools. Use is concentrated on problem solving, simulation, drill, information retrieval and data base analysis, and computer science. Mathematics is largest use area, with science, social studies, and business education using a great deal of computer time also.

Hardware

HP 2000F and C; Burroughs B3500 (2)

Software

BASIC, FORTRAN, COBOL, LOGO.

MILWAUKEE PUBLIC SCHOOLS

Richard H. Bergman
Director of Data Processing
Milwaukee Public Schools
Administration Building
5225 West Vliet Street
Post Office Drawer 10K
Milwaukee, Wisconsin 53201

Applications

Math, physical science and social sciences, vocabulary building, game playing and simulations, guidance, drug abuse education, driver education, decision development, optional mini courses on computers, various administrative tasks.

Hardware

PDP 11/20 time sharing system. Have three mobile trailers equipped with unit record equipment are used by the business education department to teach data processing principles with emphasis on career employment. Plan to expand to PDP 11/45 - 24 user system in January 1975. Texas Instrument Silent 700 used for administrative tasks.

Software

Huntington I and II, Project Delta, Decus, Hewlett-Packard, 101 Games, and numerous user written programs.

PROJECT LACE

John C. Storlie
Director, Computer Center
University Computer Center
University of Wisconsin
LaCrosse, Wisconsin 54601

Background

LACE (LaCrosse Area Computers in Education) is the name of a computer project of the University of Wisconsin Computer Center that makes computers accessible to colleges and secondary schools in Wisconsin

Hardware

HP 2000C, 30 remote terminals including 13 on UWL campus and 17 in high schools, elementary schools, and colleges in the state of Wisconsin.

Software

Problem Solving, programming skills, simulations (business, social studies, biology, chemistry, physics, etc.), CAI (limited use), and school administrative programs to include salary schedule simulation (costing), and enrollment projections.

SHAWNEE MISSION PUBLIC SCHOOLS

Terry Parks, Ph.D.
Director of Basic Services
Shawnee Mission Public Schools
Administration Building
7235 Antioch
Shawnee Mission, Kansas 66204

Instructional

CAI - remedial tutoring to 45 students; CMI - serves 100 teachers, 500 students. Courses in computer science, simulations. CMI seems to be the most widely used application in the school system. 15 to 20 teachers and staff members have developed a variety of computer managed instruction techniques which range from game simulations to an extremely sophisticated curriculum materials management system. APL is key language.

Hardware

IBM 360/40

Software

Languages - APL, FORTRAN, COBOL, PL/1, WHATFOR

SCHOOL DISTRICT OF KANSAS CITY

Thomas A. Hartley, Jr.
CAI Project Director
School District of Kansas City, Mo.
7618 Wyandotte Street, Room 214
Kansas City, Missouri 64114

Applications

Junior high mathematics - Kansas City's 8th graders have had a history of falling far below the national norm on the math portion of national achievement tests. CAI programs have significantly raised the level. The average scores are now above the national norm. Science program (30 hours), drill practice, gaming, simulation.

Hardware

IBM system 370/135 which simultaneously handles CAI as well as routine data processing operations. There are presently 22 CAI terminals (IBM 3277s) located in 2 junior high schools both at remote locations from the central processor. Planning expansion of CAI to 8 schools with a total of 64 terminals.

Software

MAT and Coursewriter II, IBM 1130

CHICAGO PUBLIC SCHOOLS

Harry Strasburg
Assistant Superintendent
or
George Litman
CAI Project
Board of Education
228 North LaSalle Street
Chicago, Illinois 60601

Applications

Computer education program - four-year sequence of computer science course in over 50 high schools in Chicago, CVIS, Drill and Practice CAI curriculum (math, reading, etc.). 20,000 student sessions per day.

Hardware

IBM 370/145, 210 terminal 80 ports, 200 keypunches.

UNIVAC 1110=688 terminals.

JEFFERSON COUNTY PUBLIC SCHOOLS

Eugene A. Collins
Instructional Computer Systems
Normandy Elementary School
6750 South Kendall Boulevard
Littleton, Colorado 80123

Applications

Algebra, simulations in physics; four one-quarter courses: beginning computer programming, advanced computer programming, computer science, and computer technology and society (this last one has not been implemented as yet), some tutorial application, guidance and counseling are being considered, testing being done by few individuals.

Hardware

Hewlett-Packard 2000C with disc storage capacity

Comments

National Science Foundation and district are supporting programs cooperatively.

ADAIR PUBLIC SCHOOLS

Mike Bolton, Principal
Adair High School
Adair, Oklahoma 74330

Applications

Computer science, programming.

Hardware

GE Mark II time-sharing computer.

Software

Languages - FORTRAN, BASIC REMAPt, Bell Telephone's CARDIAC simple machine language.

Comment

Adair participated in the 1970 survey and was one of the schools AIR interviewed. Adair and Tulsa Edison were the only two schools in 1970 in the northeast section of Oklahoma to use computers in their curriculum.

AREA 9 SCHOOLS

Donald Schaefer
Physics Teacher
Bettendorf High School
Bettendorf, Iowa

Applications

Mathematics, physics, chemistry, and general science

Hardware

Edusystem 50

History

Begun in January 1970. Twelve schools in Clinton, Muscatine, and Scott Counties involved.

REGION IV EDUCATION SERVICE CENTER

T. S. Hancock
Executive Director
Region IV Education Service Center
Houston, Texas 77002

Background

Consortium uses an RCA Spectra 70/46 and 70/45 at the Center in downtown Houston. Eventually all 225 secondary schools in the Region will be provided complete educational data processing capability.

Applications

Problem-solving in math, physics, and chemistry, and computer skills.

EDUCATION SERVICE CENTER, REGION 10

Education Service Center, Region 10
400 East Spring Valley
Richardson, Texas

Background

Consortium of 26 schools in the district in North Texas Area.

Applications

Problem Solving, Programming (grades 5-12), CAI reading (grades 9-12), CAI math (grades 3-10), Guidance Information System (grades 8-12), Special Education, and Administrative applications for grade reporting, and scheduling.

KILLEEN INDEPENDENT SCHOOL DISTRICT

Ron Heuss
Assistant Principal for Scheduling
Killeen Independent School District
Post Office Box 967
600 Williamson Street
Killeen, Texas 76541

Applications

Presently for scheduling and grade reporting. Future plans include CAI for the mentally gifted in math and later in science. Success depends on federal funding and local financing.

Comments

Working in conjunction with Central Texas College via the EPIC: SOCRATES program.

OTIS - OREGON TOTAL INFORMATION SYSTEM

Ben Jones
Manager of Instructional Services
354 East 40th Avenue
Eugene, Oregon 97504

Background

The Umatilla I.E.D. and schools in Umatilla County, Oregon, participating with a number of other schools launched in 1967 a project called OTIS (Oregon Total Information System). The project was managed by the Lane I.E.D. in Eugene, Oregon. The computer system was primarily an administrative system with the intent to provide instructional services as resources were available.

The system is a remote teleprocessing environment with at the present time approximately 175 terminals located in schools across the state of Oregon. To meet the growing need for instruction, it was deemed necessary that a separate computer was required to fulfill the requirements. A tempo mini-computer was installed to provide telecommunication interface with the computer systems. This allows the capability of using the same terminal for administrative services and instructional services through a simple switch command. This provides a great opportunity for small school districts whose

administrative needs are not great enough to require a dedicated administrative terminal in the school district. This allows sufficient time for student use to provide a reasonable environment for instructional supplement.

Applications

CAI (Math Drill and Practice), Simulating CMI (limited) Student Problem Solving.

Hardware

2 H-P 2000F